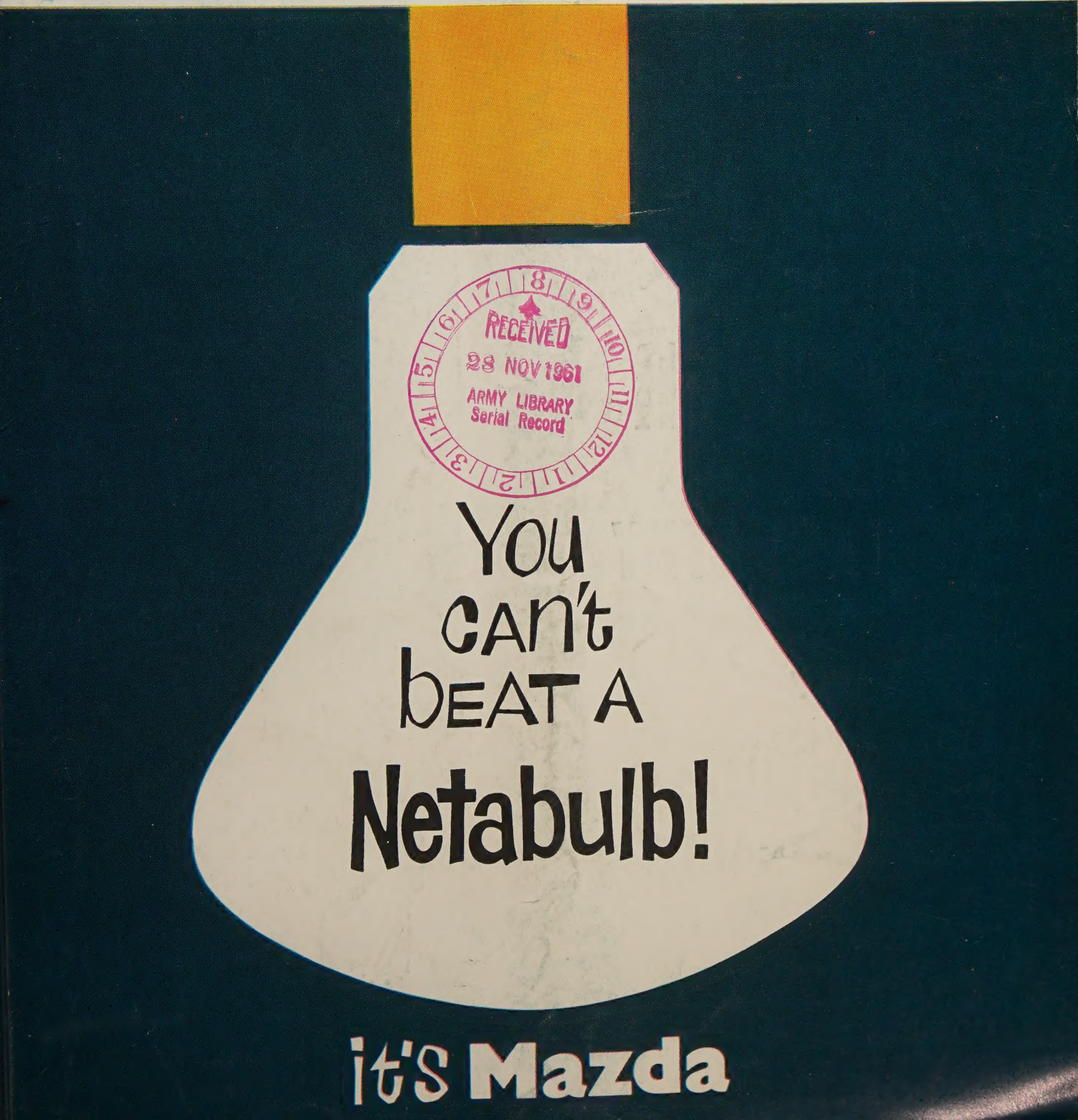
ELECTRICAL REVIEW

Eptra 02

FRIDAY
NOVEMBER 1961

WEEKLY
PRICE 1s 6d


You can't beat a Netabulb!
it's Mazda

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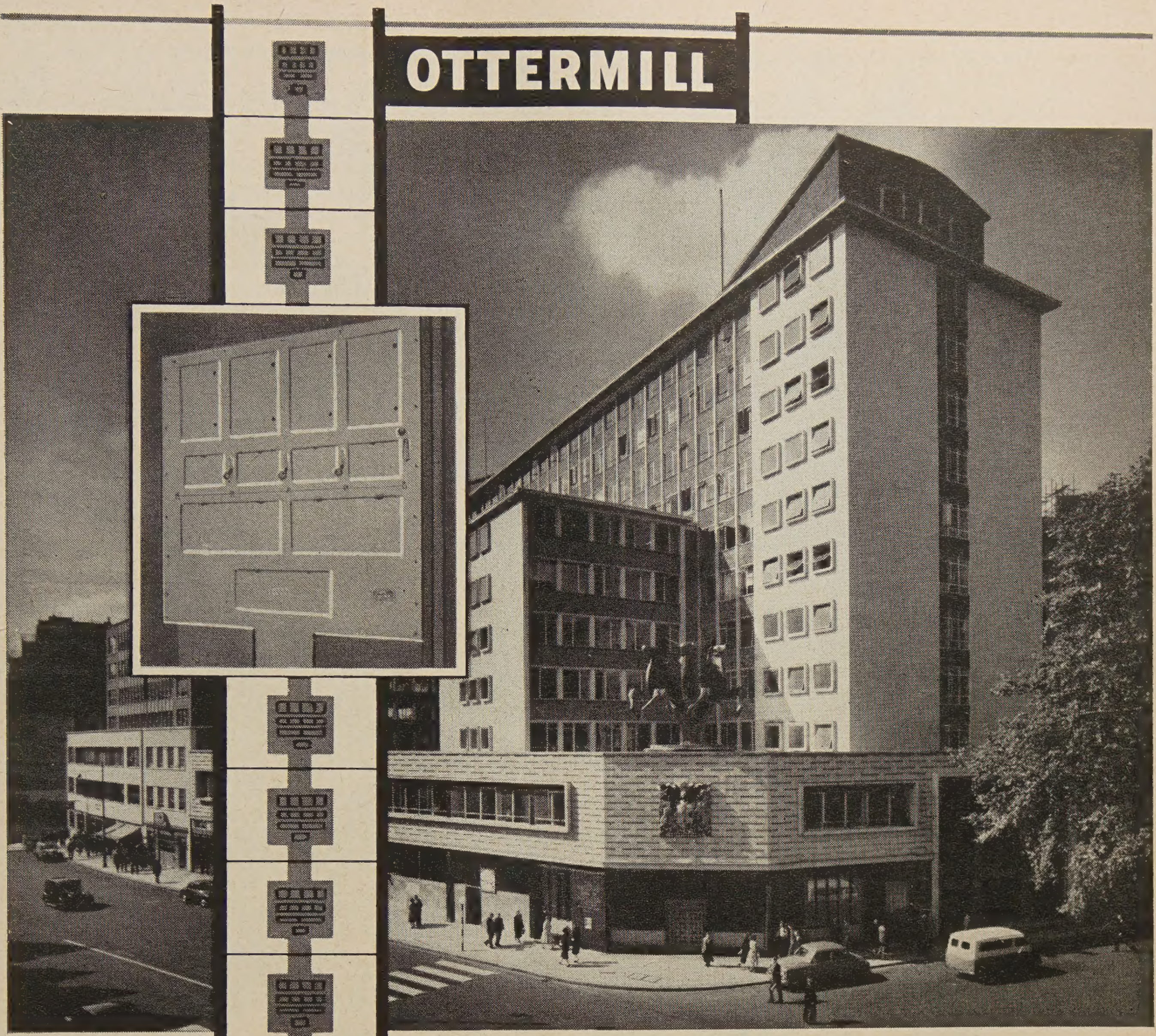
MORE
POWER
FOR
INDUSTRY

WITH

BICC
CABLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 Bloomsbury Street, London, W.C.1

OTTERMILL



RISING MAIN BUSBAR SYSTEMS

This impressive example of an Ottermill Rising Main Busbar System is incorporated in Caltex House which was erected by Sir Robert McAlpine and Sons, Ltd., on the famous Tattersalls site in Knightsbridge. On each floor, accommodating tenants' switchgear and supplying authorities' fuses and metering, are Ottermill Cubicle Switchboards.

Our engineers would be pleased to give technical advice and assist in preparation of layouts.

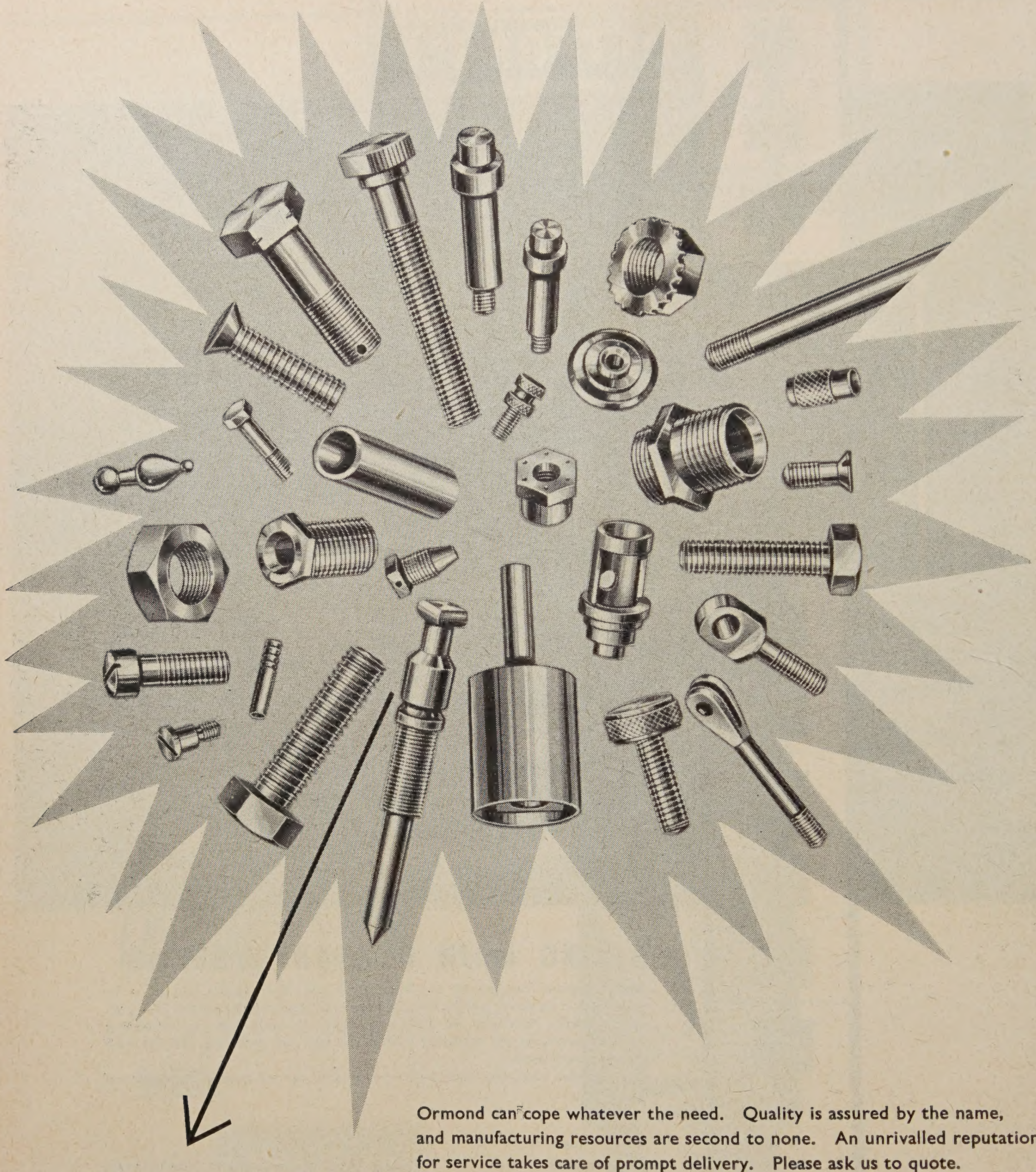
Write for Leaflet R.M. 701/57

ARCHITECTS	BUILDERS	ELECTRICAL CONTRACTOR
Stone, Toms and Partners, 28 South Audley St, W.1.	Sir Robert McAlpine & Sons Ltd, 80 Park Lane, W.1.	Edmundsons, Construction Co. Ltd., 30 Gillingham Street, W.1.

OTTERMILL SWITCHGEAR LTD

SALES OFFICE: 166 VICTORIA STREET, LONDON, S.W.1

Telephone: ABBey 5095/6



Repetition work

Ormond can cope whatever the need. Quality is assured by the name, and manufacturing resources are second to none. An unrivalled reputation for service takes care of prompt delivery. Please ask us to quote. Any quantity.

The Repetition Parts range covers single and multi spindle automatics up to 1¼″ dia., Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grubscrews, Nuts, Allthreads, Hexagon Bolts and Setscrews turned from bar and Cold Headed Grades "A", "B", and High Tensile.

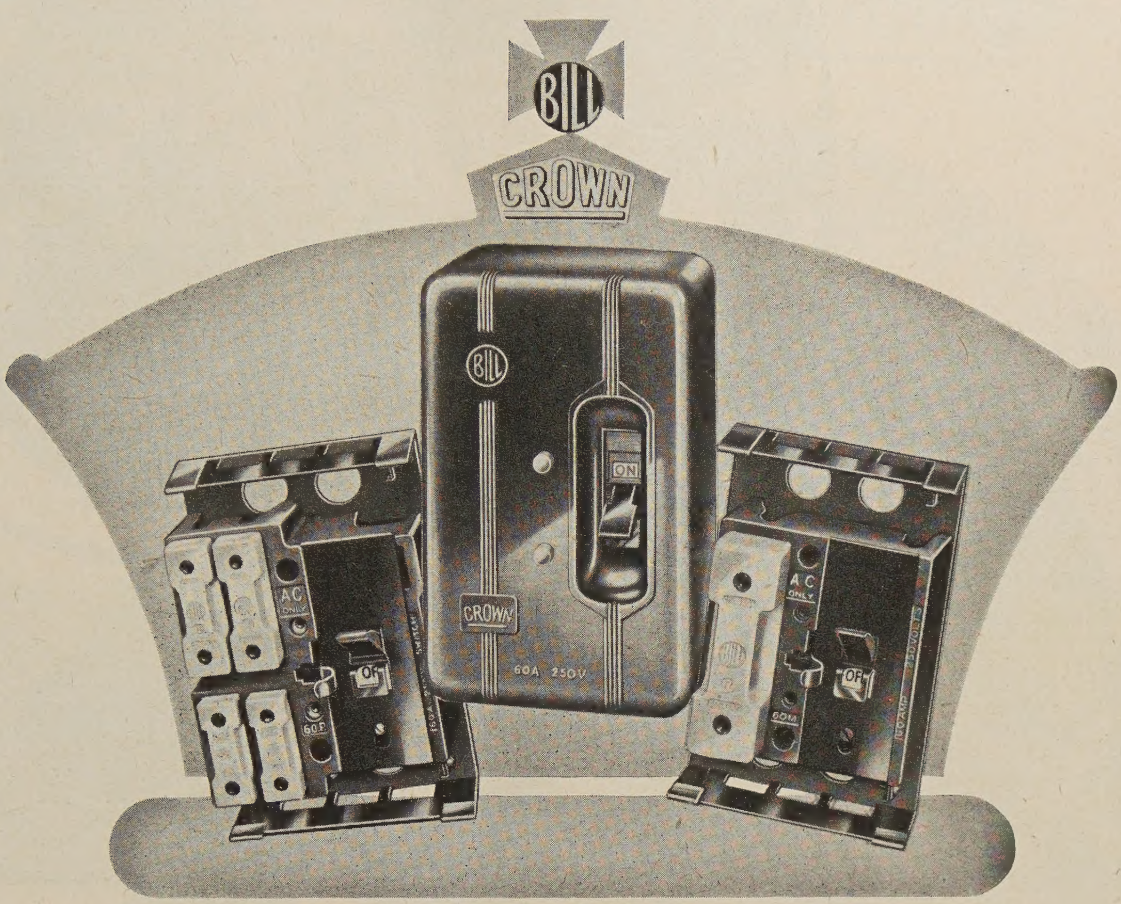
ENGINEERING ORMOND COMPANY LTD.

THE ORMOND ENGINEERING CO. LIMITED

Ormond House, Rosebery Avenue, London, E.C.1

Telephone: TERminus 2888 Telegrams: "Ormondengi, Cent"

You cannot buy better gear



SWITCHFUSES AND SWITCH SPLITTERS
NEW PRICES

- A RANGE OF S.P. & N. MAIN SWITCHGEAR FOR MODERN DOMESTIC INSTALLATIONS.
- AVAILABLE IN 15, 21, 30, 34 AND 60 AMP. SWITCH RATINGS.
- SAFE AND RELIABLE SLOW-BREAK A.C. FRONT OPERATED SWITCHES.
- ALL-INSULATED OR METAL CASES—FULLY INTERLOCKED FOR SAFETY.
- VITREOUS PORCELAIN FUSES IN H.R.C. OR BILL ARC DAMPING TYPE.

ASK FOR ILLUSTRATED PRICE LIST No. CR.761

PRICE LIST PL.561 OR NEW CATALOGUE G.561 NOW AVAILABLE

BILL SWITCHGEAR LTD.
ASTON LANE · PERRY BARR
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A. W. ZELLEY,
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GLASGOW
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DONEGALL ST.

Photograph by courtesy of
Associated-Rediffusion Ltd.

Reyrolle 5-ampere plug
and socket to B.S. 196

More than 2000 Reyrolle protected-type plugs and sockets are used in the No. 5 Studio of Associated-Rediffusion at Wembley Park to facilitate the flexible control of lighting and other fittings

Reyrolle

A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

The case for brushless is overwhelming!

No wonder Industry is installing AEI BRUSHLESS A.C. GENERATORS

Maintenance costs cut dramatically . . . because there are *no* brushes to inspect or replace, *no* carbon brush dust to endanger insulation, *no* sliprings to be re-ground, *no* commutator to be skimmed.

Because sparking cannot occur fire risk is inherently low.

AEI brushless A.C. generators are particularly useful for standby duty and for service in situations remote from grid supplies.

Write now for leaflet to:

Despite all their advantages brushless A.C. generators cost no more than alternative equipment and are available in an extensive range from 50 kVA up to 5,000 kVA.

AEI

Associated Electrical Industries Limited

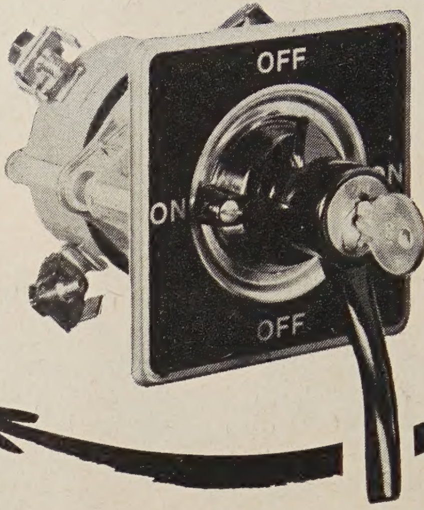
Heavy Plant Division

RUGBY, ENGLAND

A5583

Specify

SANTON



LOCKABLE SWITCHES.

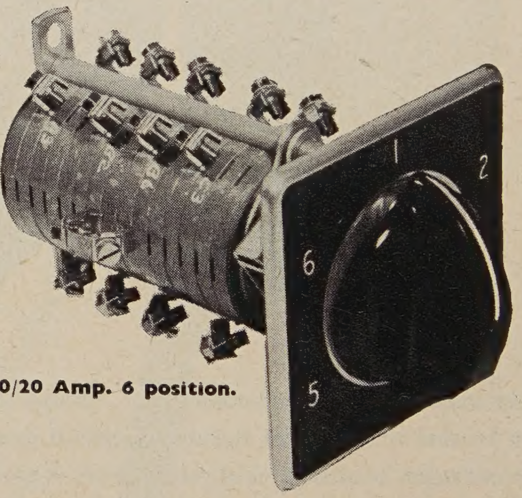
ROTARY SWITCHES

For your control equipment

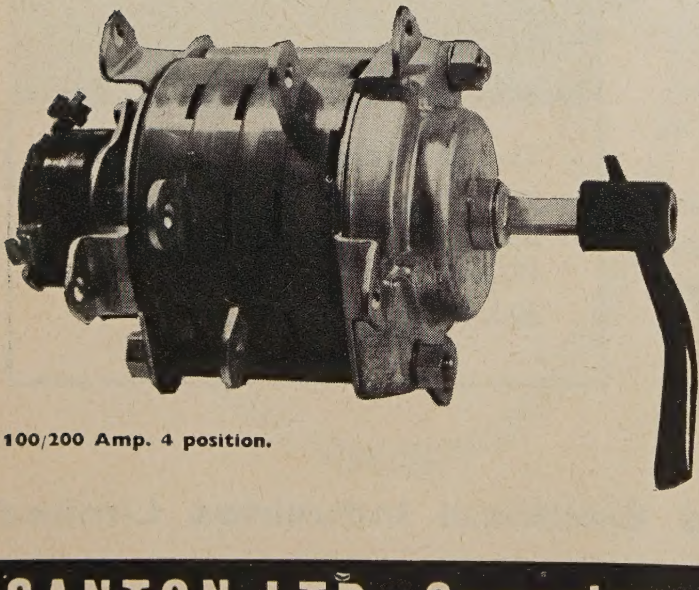
A range of compact and robust packet type rotary switches available for use on voltages up to 600v. A.C. and D.C.

Single and multipole variations can be supplied to meet most of the requirements of the electrical industry.

Slow make and break A.C. and quick make and break A.C./D.C. mechanisms available.



10/20 Amp. 6 position.

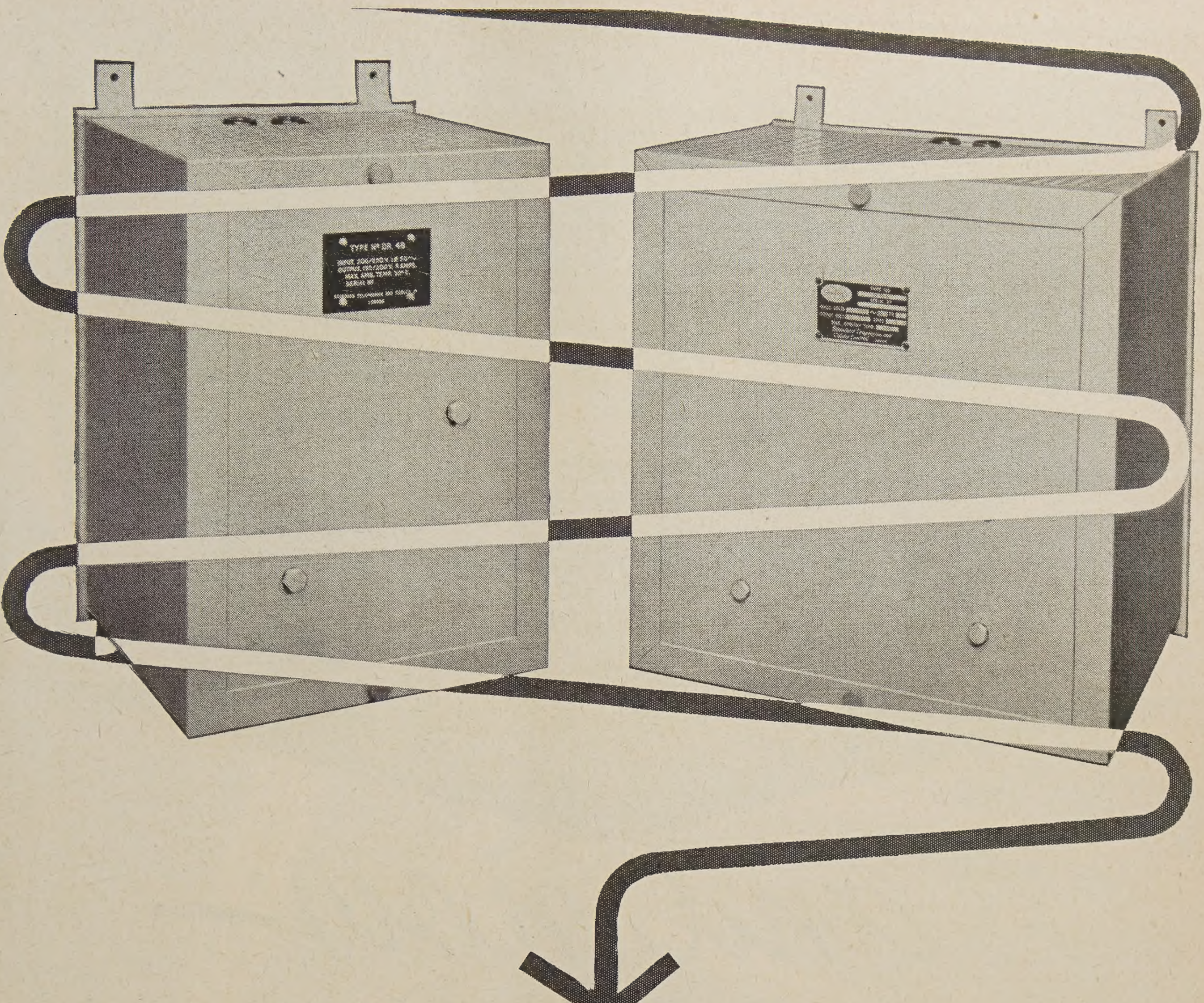


100/200 Amp. 4 position.

Throughout the whole range, switches can be offered to meet the requirements of Admiralty, Ministry of Supply, Air Ministry, United Kingdom Atomic Energy Authority, G.P.O., Lloyds, C.S.A. and many Continental testing Authorities.

Full particulars of each type of switch available on request.

SANTON LTD., Somerton Works, Newport, Mon.



SenTerCet

LOW & MEDIUM POWER D.C. RECTIFIER EQUIPMENTS

FOR USE AT MAINS VOLTAGE

Amongst this large range of equipments there is a model for most purposes requiring small to medium power. They are simple, inexpensive, require practically no maintenance, and have substantial inherent overload capacity. There are two general types as follows:

TYPE A.T.R.

Input to double wound transformer is from A.C. mains of any normal voltage including either single or three-phase. Output: 88 models are available, with D.C. outputs at 100/120 V., 200/250 V. or 400/460 V. Current ratings of from 0·075 Amp to 84 Amps at an ambient temperature of 30°C.

Typical Applications

D.C. to A.C. Change-over and general D.C. power supplies
D.C. machinery and alternator excitation
Power supplies for D.C. motors
Magnetic Valves
Magnetic chucks and all Electro-Magnetic equipments
D.C. Power Supplies for Control Gear

TYPE D.R.

Input: Direct to rectifier from A.C. mains of any normal voltage, thus saving the cost of a transformer in cases where the required D.C. output is of the same order of voltage as its A.C. input.
Output: 53 models are available with various D.C. outputs, between 70/90 V. and 495/550 V. Current ratings of from 0·075 Amp to 80 Amps at an ambient temperature of 30°C.

Typical Applications

D.C. machinery and alternator excitation
Magnetic Valves
Magnetic chucks and all Electro-Magnetic equipments
D.C. Power Supplies for Control Gear

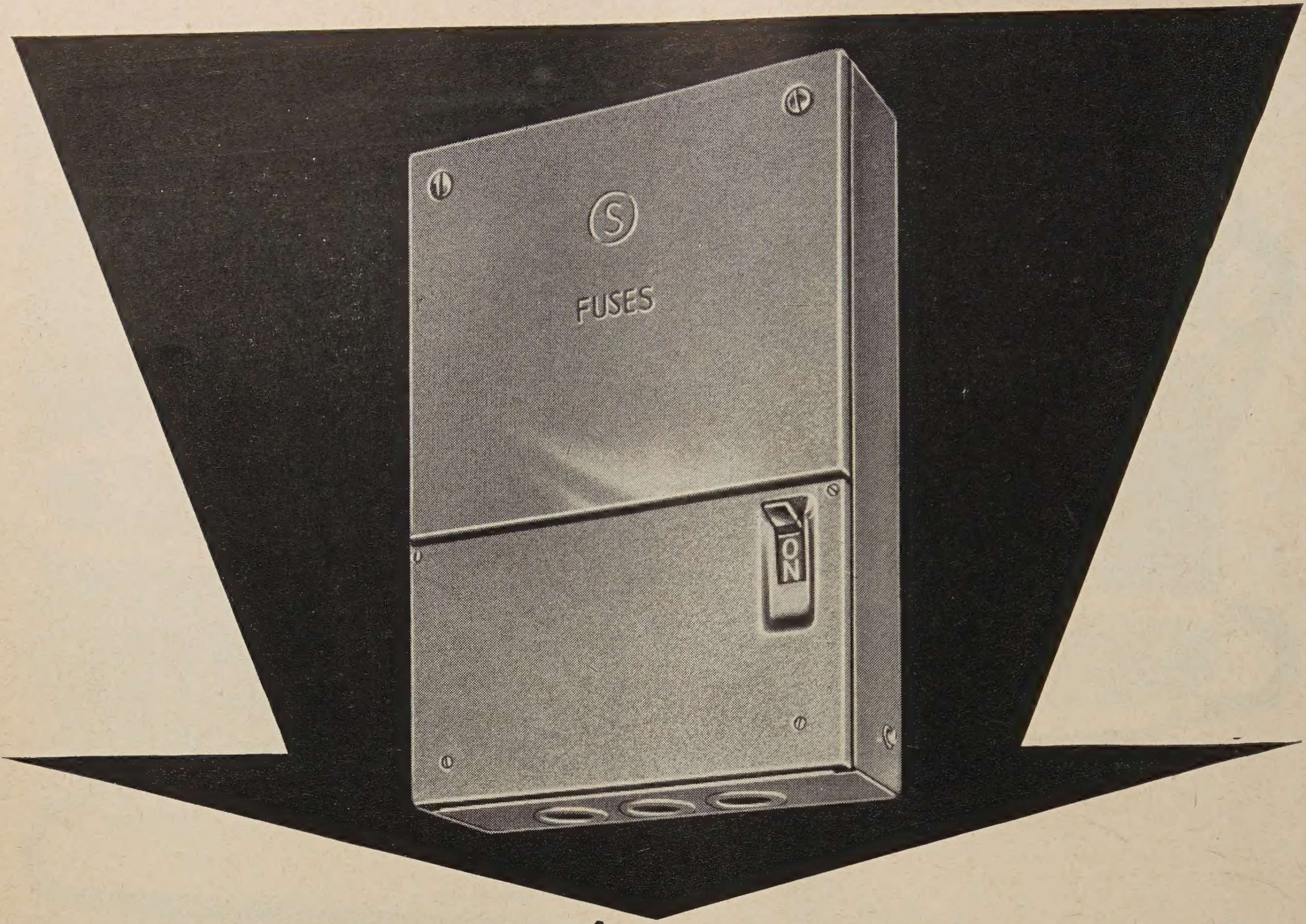
Ask for Bulletins F/ATR.1 and F/DR.1.

STC

Standard Telephones and Cables Limited

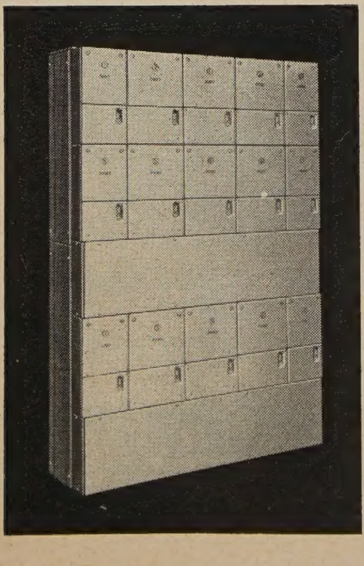
RECTIFIER DIVISION: EDINBURGH WAY · HARLOW · ESSEX

60/10MF



and now—

the outstanding new SANDACEE range of A.C. switch fuses



Build your switchpanels into compact space-saving units with SANDACEE A.C. Switch fuses. Smooth projection-free casing permits any form of unit assembly without spacings. Features include fully interlocked front-operated switch having heavy duty solid silver contacts and with ON/OFF indicator.

"Sandaspeed" Duplex fuse units with inter-changeable, re-wireable, or H.R.C. Carriers throughout the range.

Neat modern design, complying where applicable with B.S. 2510 and B.S. 861, affords ample wiring space for fully universal wiring with maximum size cable. Available in S.P. & N., D.P., T.P., T.P. & N. 15, 30, 60, 100 Amp. 440 v. A.C. only.

Send for leaflet No. 162/61.

SANDERS

WILLIAM SANDERS & CO. (WEDNESBURY) LTD.
FALCON ELECTRICAL WORKS,
WEDNESBURY, STAFFS.

For all types of

CARTRIDGE THERMOSTATS
OVER-HEAT SWITCHES
CONTACT THERMOMETERS
—fixed or adjustable

ELECTRO METHODS LTD. STEVENAGE
CARTRIDGE TYPE 310
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CARTRIDGE TYPE 314

contact... **ELECTRO METHODS** LTD
OF STEVENAGE

ELECTRICAL COMPONENTS & CONTROL EQUIPMENT

An extensive range of standard controls
always available for prompt delivery

SPECIAL TYPES DESIGNED TO SUIT *YOUR* NEEDS

Full technical data
forwarded on request :—

ELECTRO METHODS LTD. General Products Division, CAXTON WAY, STEVENAGE, HERTS. Phone: Stevenage 2110-7

Walsall Conduits Ltd
EXCELSIOR WORKS WEST BROMWICH
PHONE TIPTON 1171 (8 LINES)

you have never seen FACTORY LIGHTING like this before . . .

High level lighting on the work-bench or drawing-office board means greater efficiency *provided* it is not accompanied by discomfort glare from the light fittings themselves. Unique design features in G.E.C. 'Comfort Lighting' enables these high levels of light to be introduced while optical control removes all glare. So the worker feels happy and comfortable, and gets on with the job more quickly and accurately.

The G.E.C. range of 'Comfort Lighting' fittings is the only one which meets the recommendations for every type of installation of the new Code for Good Interior Lighting issued by The Illuminating Engineering Society. Write for the 40 page illustrated brochure F4695, or better still, ask us to send a Lighting Engineer. Our Lighting Advisory Service is entirely free and without obligation, and is available to advise on the smallest lighting problem or design the largest scheme.

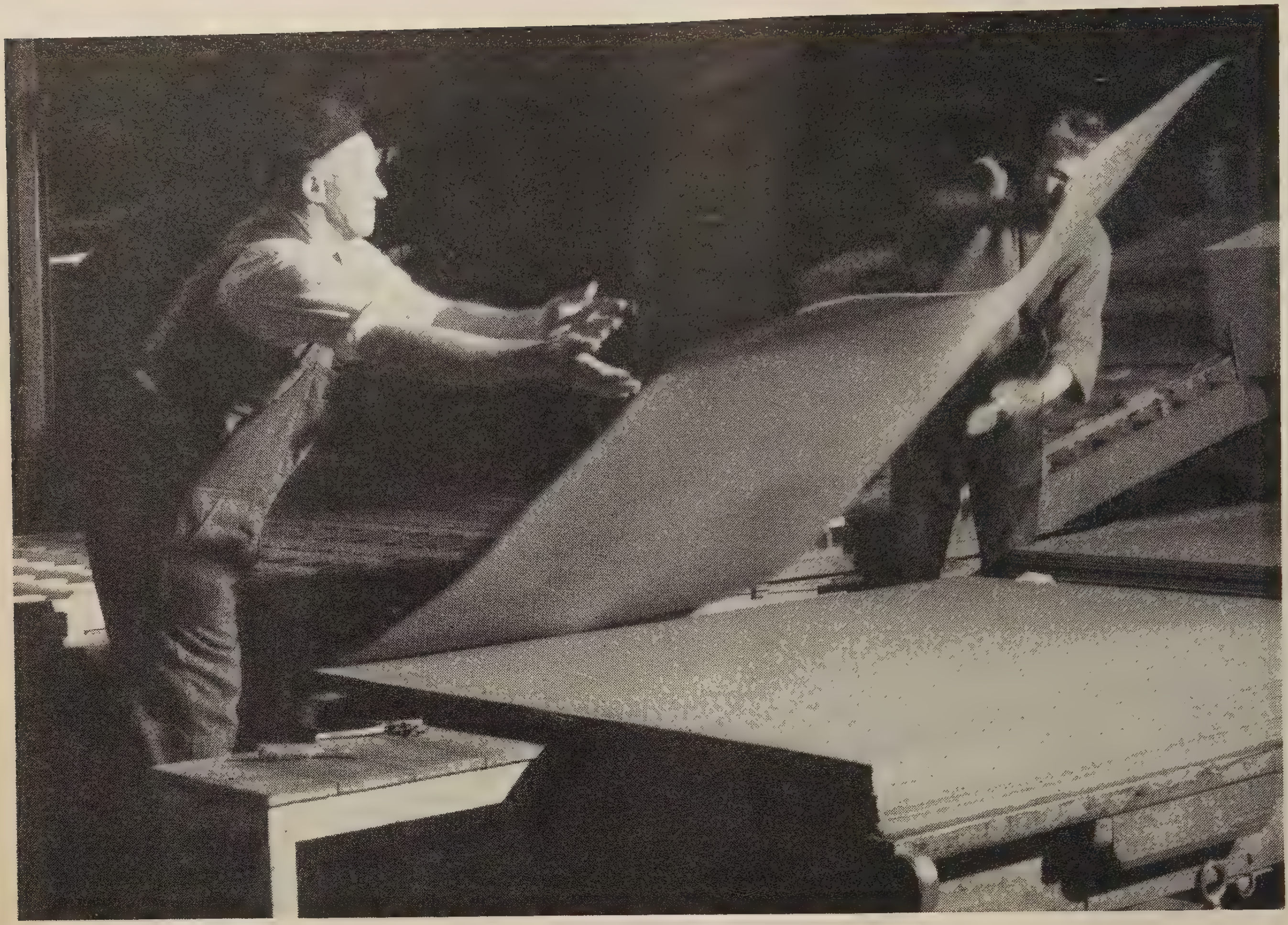
comfort in lighting

means high level illumination without discomfort glare.

G.E.C.

LIGHTING & HEATING GROUP

LIGHTING AND HEATING GROUP · THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE KINGSWAY · LONDON · W.C.2



THIS BEGINNING——

marks the end of many electrical problems.

" CASTLE " vulcanised fibre manufactured to B.S.S.216 : 1961. Proven for insulating purposes with high dielectric value, toughness and resilience, it is used throughout the Electrical Industry—

from Arc Control to Cord Grips

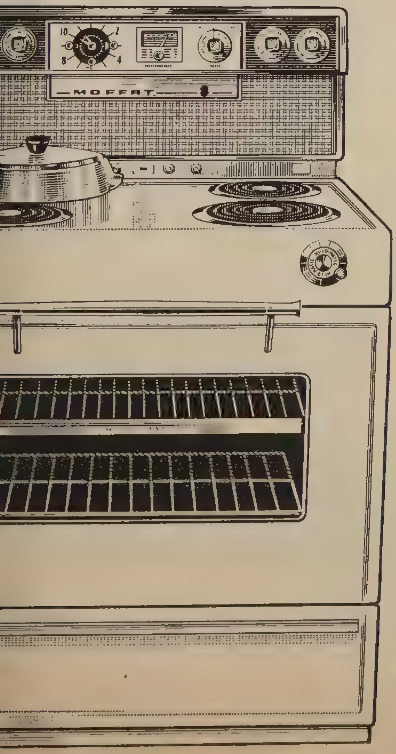
V F
TRADE MARK

Vulcanised Fibre Ltd

BROADFORD MILLS, GUILDFORD, SURREY
ROYAL BUILDINGS, 2 MOSLEY ST., MANCHESTER 2

MOFFAT

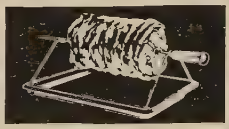
The cooker that collects a crowd



Crowds gather wherever there's a MOFFAT on view. That's general experience in showrooms all over the country! People don't need coaxing . . . the sight of the cooker alone is enough to make them admire—and buy! It's the features that fetch them . . . features that every woman's looked for in other cookers but never found till now. In MOFFAT, the cooker that's so easy to sell! Now in a wide range of prices and styles—Free Standing or 'Built-In' versions (to fit a custom kitchen) or the new Fiesta cabinet model.

A COMPLETE RANGE OF MODELS IS AVAILABLE IN 24", 30" AND 40" SIZES AS WELL AS BUILT-IN OVENS AND SURFACE UNITS.

Write for details or, better still, see the whole MOFFAT range at our Showrooms at Moffats Limited, 37 Davies Street, London, W.1. We welcome trade enquiries at any time.

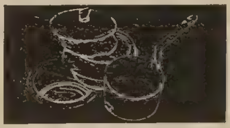


ROTISS-O-MAT SPIT

Quickest, most flavoursome way to roast. Self-basting seals in flavour, juices, goodness—*stops meat shrinkage.* Uses regular oven thermostat settings. Can be timed with automatic clock.

HI-LO-MATIC SHELF

Precision grilling and baking are matters of turning an elevator knob. The shelf can be raised or lowered without opening oven door. Oven preheats to 350° in just over 4 minutes!



THERM-O-GUARD HOTPLATE AND DEEP WELL COOKER

This thermostatically controlled hotplate makes every utensil *fully automatic!* Clock-control allows absentee operations. Accommodates exclusive Deep Well Cooker/Deep Fat Fryer.

ROAST METER

Now—joints are cooked *automatically!* The preference (rare, medium, well-done) is dialled, the electric meat thermometer probe is thrust into the joint . . . and buzzer signals when it's done—to perfection.

MOFFAT

Danger surrounds creatures of the fields and forests. Nature has equipped them to sense it, to be alert to every slightest warning and to take evasive action—on the instant.

In all the years since man first harnessed electricity he has relied on *porcelain* for protection against its hazards. Most widely used insulation material in the industry, porcelain is both versatile and economical.

WADE porcelain has an unsurpassed reputation for accuracy and dependability.

WADE technicians are at your service to go anywhere at anytime. Your enquiries are welcomed and will receive immediate attention.

Think fast Mister Hare!

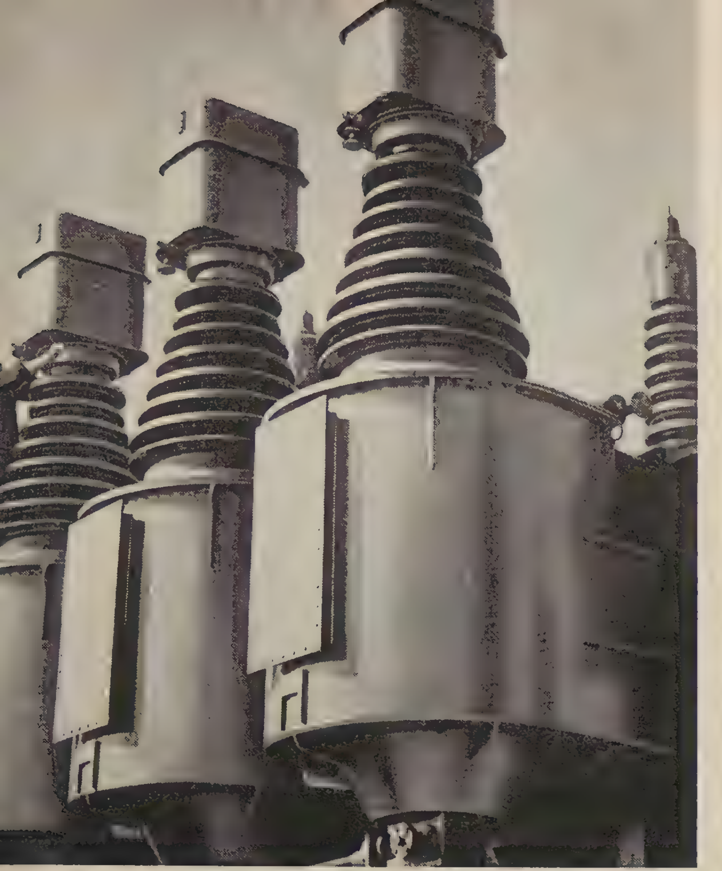
BECMA
BRITISH ELECTRO CERAMIC MANUFACTURERS' ASSOCIATION

WADE

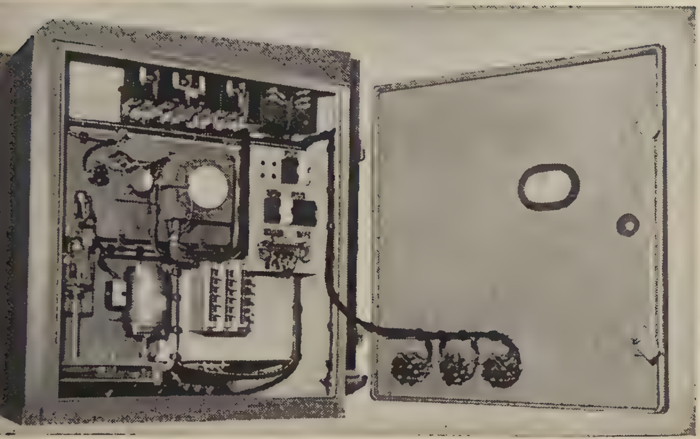
ELECTRO – CERAMICS

Geo. Wade & Son Ltd., Burslem, Stoke-on-Trent
Wade (Ulster) Ltd., Portadown, Northern Ireland
Members of the Wade Group of Potteries

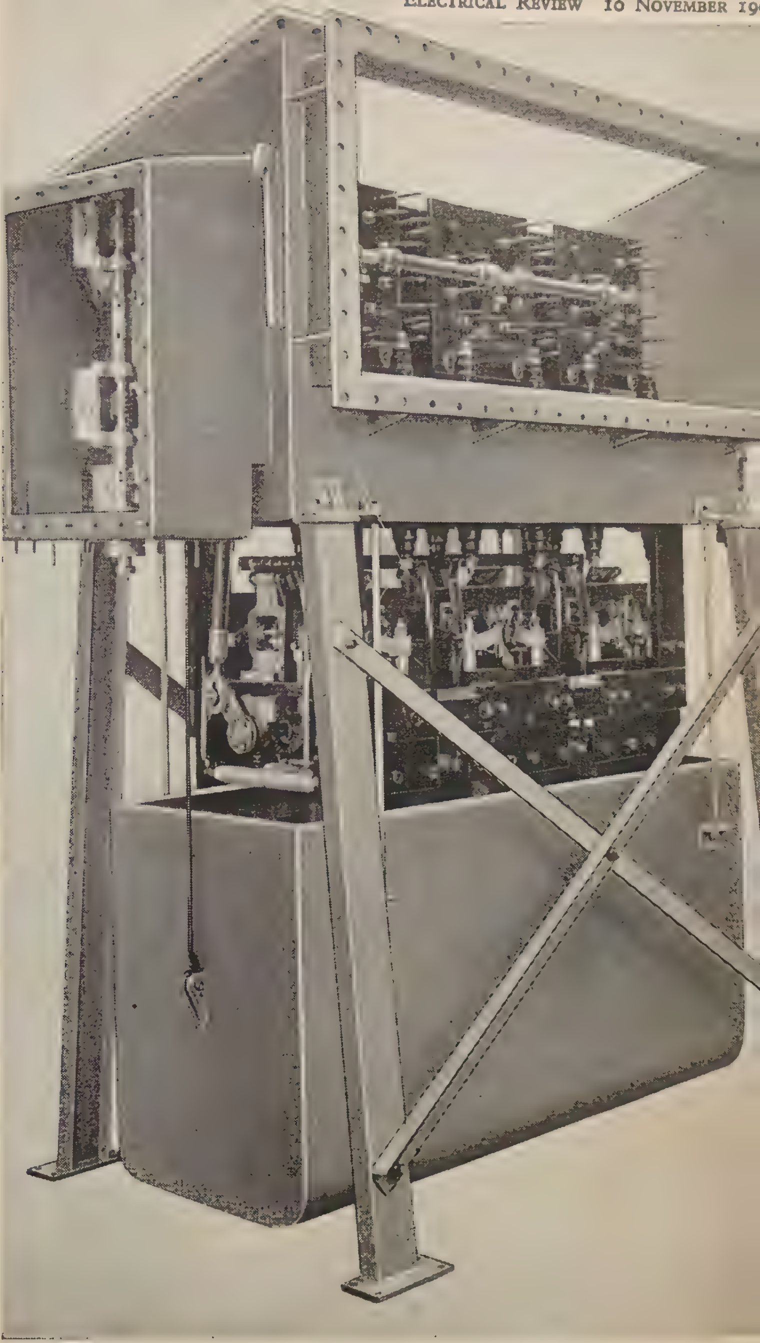
PORCELAIN FOR INSULATION....WADE FOR PORCELAIN



Type HS 132 kV Fully Insulated



Type "F" up to 33 kV, 200 amps



Type HS up to 66 kV, 400 amps

ON-LOAD TAP CHANGERS

As manufacturers of Transformers up to the largest sizes and highest voltages, we are in the forefront in the design and manufacture of high-speed resistor on-load tap changers for a wide range of applications. Designed as self-contained units for direct attachment to the Transformer tank, our equipments are supplied to other Transformer manufacturers both home and overseas.

Our very considerable output of tap changers has enabled us to effect a great measure of standardisation without limiting in any way the extensive range of applications.

CURRENT RATINGS and VOLTAGES

On-load tap changing equipment is available for service voltages:—
11 kV, 33 kV, 66 kV, fully insulated.
132 kV Neutral end or fully insulated.
275 kV Neutral end or fully insulated.
Current ratings: 100 up to 1250 amps.

These ratings cover requirements for power transformers up to the argest ratings and highest service voltages.

consult—

FULLER ELECTRIC

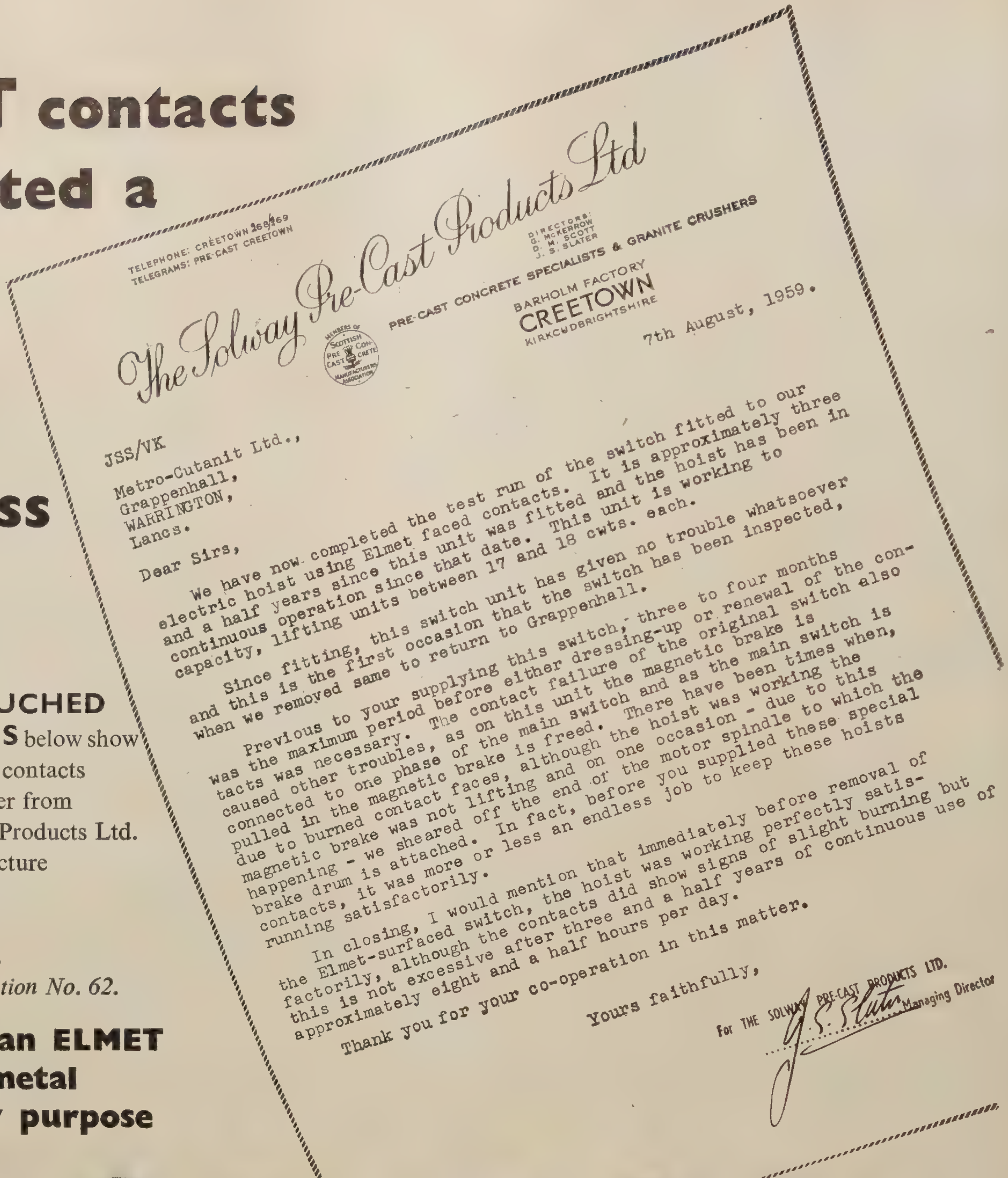
A member of the Hawker Siddeley Group

Sole U.K. representatives for ASEA Swede

FULLER ELECTRIC LIMITED
FULBOURNE ROAD · LONDON E.17
Telephone: LARkswood 2350

Also at Birmingham, Glasgow and Manchest

ELMET contacts eliminated a "more or less endless job"



TELEPHONE: CREETOWN 268/269
TELEGRAMS: PRE-CAST CREETOWN

The Solway Pre-Cast Products Ltd

MEMBERS OF SCOTTISH PRE CAST CON-CRETE MANUFACTURERS ASSOCIATION

PRE-CAST CONCRETE SPECIALISTS & GRANITE CRUSHERS

DIRECTORS:
G. McKERROW
D. M. SCOTT
J. S. SLATER

BARHOLM FACTORY
CREETOWN
KIRKCUDBRIGHTSHIRE

7th August, 1959.

JSS/VK

Metro-Cutanit Ltd.,
Grappenhall,
WARRINGTON,
Lancs.

Dear Sirs,

We have now completed the test run of the switch fitted to our electric hoist using Elmet faced contacts. It is approximately three and a half years since this unit was fitted and the hoist has been in continuous operation since that date. This unit is working to capacity, lifting units between 17 and 18 cwts. each.

Since fitting, this switch unit has given no trouble whatsoever and this is the first occasion that the switch has been inspected, when we removed same to return to Grappenhall.

Previous to your supplying this switch, three to four months was the maximum period before either dressing-up or renewal of the contacts was necessary. The contact failure of the original switch also caused other troubles, as on this unit the magnetic brake is connected to one phase of the main switch and as the main switch is pulled in the magnetic brake is freed. There have been times when, due to burned contact faces, although the hoist was working the magnetic brake was not lifting and on one occasion - due to this happening - we sheared off the end of the motor spindle to which the brake drum is attached. In fact, before you supplied these special contacts, it was more or less an endless job to keep these hoists running satisfactorily.

In closing, I would mention that immediately before removal of the Elmet-surfaced switch, the hoist was working perfectly satisfactorily, although the contacts did show signs of slight burning but this is not excessive after three and a half years of continuous use of approximately eight and a half hours per day.

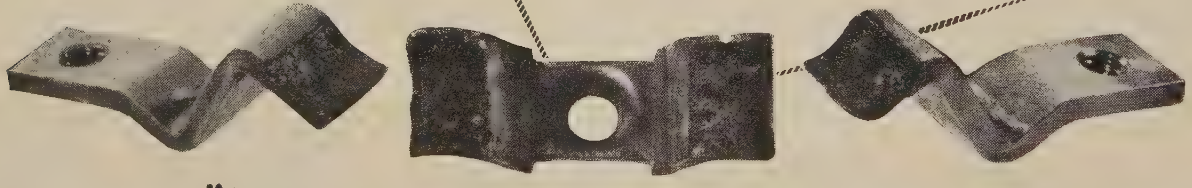
Thank you for your co-operation in this matter.

Yours faithfully,

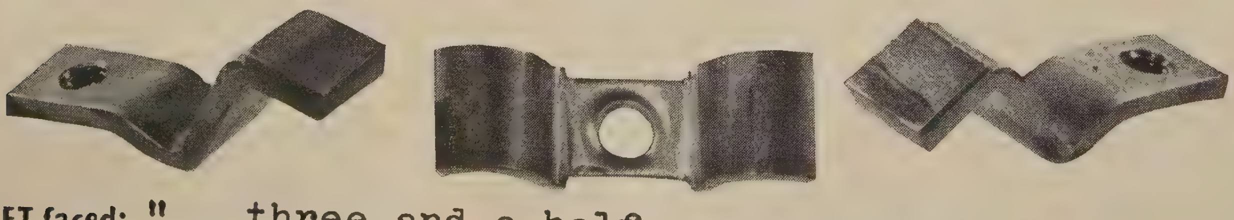
For THE SOLWAY PRE-CAST PRODUCTS LTD.
J. S. Slater
Managing Director

THE UNRETOUCHED PHOTOGRAPHS below show the two actual sets of contacts referred to in this letter from The Solway Pre-Cast Products Ltd. Those in the upper picture are plain contacts, while the lower set have ELMET facings.
Please ask for Publication No. 62.

There is an ELMET contact metal for every purpose



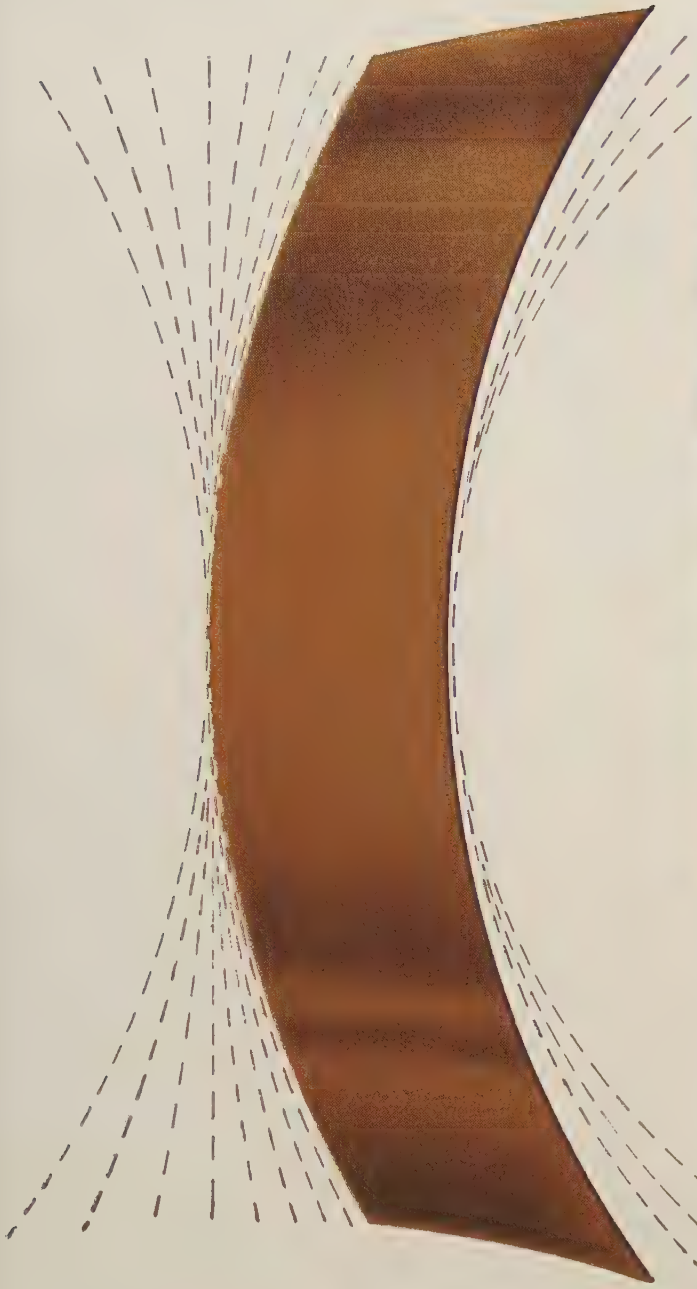
PLAIN contacts: "three to four months was the maximum..."



ELMET faced: "...three and a half years of continuous use"

METRO-CUTANIT LIMITED GRAPPENHALL WARRINGTON LANCASHIRE
Telephone: Grappenhall 906/8

Broadway/mc6



MALLORY 53

Intermediate in cost between phosphor bronze and beryllium-copper, the new Mallory 53 nickel-silicon-copper alloy has mechanical properties at least equal to those of conventional phosphor bronzes and brasses, coupled with a far higher electrical conductivity. Thermal conductivity, too, is high.

The material is ideal for contact support springs, especially in miniature components, and is supplied as strip in the precipitation-hardened condition. All spring-forming operations can be performed without the need for further heat-treatment. Finished parts to users' drawings can be produced.

Full technical details on request

Higher current capacity ... no heat-treatment

Typical Properties of Mallory 53	
Specific gravity	8·5
Vickers hardness	195 – 220
Tensile strength, *tons per sq in*	40 – 45
Elongation, *per cent (2 inches)*	12 – 16
0·1% Proof stress in tension, *tons per sq in*	30 – 35
Electrical conductivity, *per cent I.A.C.S.*	40 – 45
Thermal conductivity, *c.g.s. units*	0·42

Johnson Matthey

MALLORY

JOHNSON, MATTHEY & CO., LIMITED controlling MALLORY METALLURGICAL PRODUCTS LTD.

73-83 HATTON GARDEN, LONDON, E.C.1 Telephone: Holborn 6989

Vittoria Street, Birmingham, 1. Telephone: Central 8004

75-79 Eyre Street, Sheffield, 1. Telephone: 29212

M11/683

The Grosvenor Flush Metal Switch in standard B.M.A. finish is illustrated above.

specify the GROSVENOR RANGE of accessories

Switches, socket outlets and combined switch socket outlets all superbly designed in attractive metal finishes to harmonise with any modern interior. Made by AEI to British Standards and backed by AEI's resources and service.

Of particular importance to Architects. The Grosvenor Range of electrical accessories can be supplied in special finishes to fit most decorative schemes. Special assemblies to meet specific requirements in public buildings such as hospitals, etc. can be made to your own specification.

AEI

Write for catalogues to:
CABLE DIVISION
Associated Electrical Industries Limited
DISTRIBUTION EQUIPMENT SALES DEPARTMENT
145 Charing Cross Road, London, W.C.2. Tel: GERrard 9797

See the full range of
AEI electrical
accessories on our
STAND No. 356/7
at the BUILDING
EXHIBITION
NOV. 15th–29th

Wootton meter boards are Trumps !

Naturally . . . when they're Wootton-made . . . and Wootton-tested ! They're made of the best plywood Wootton could lay hands on. Tested for reliability . . . toughness . . . durability. Wootton meter boards stand up to anything. Even in the most extreme climates. No contraction or expansion or warping with Wootton ! Oh, and there's more to Wootton than just meter boards. They make wood blocks too, and instrument cases, and they're aces at sunk switch boxes.

WOOTTON-the meter board people

WOOTTON & CO. LTD
ALMA WORKS · PONDERS END · MIDDX
Telephone: HOWard 1858

Flawless

No, we shall not be silly and claim that our castings are as flawless as a piece of 16th century Venetian Glass. But we can go this far : we can say that just as the old master craftsmen got great satisfaction out of doing a job as well as it could possibly be done, so do we. That is why so many customers whose castings must have a fine skin which will readily anodise put their trust in Great Bridge Foundries

PRECISION CASTINGS IN ALUMINIUM, GUN METAL, GREY IRON, ETC. TO ALL SPECIFICATIONS

Phos. bronze and gun metal solid and cored sticks always in stock

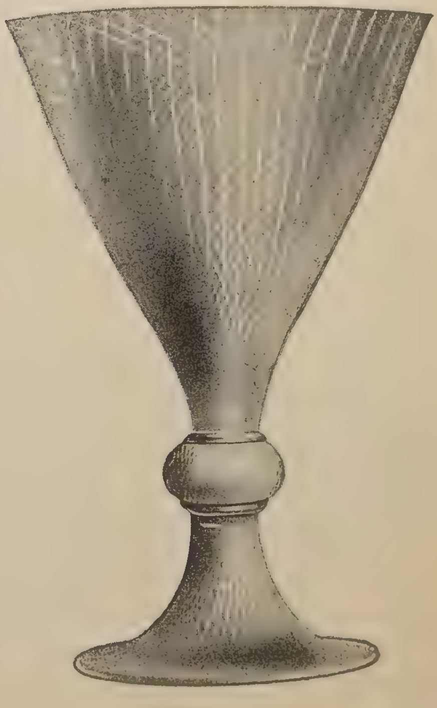
THE GREAT BRIDGE
FOUNDRY CO. LTD.

Sheepwash Lane Great Bridge - Tipton
Staffordshire Telephone: TIPton 2914/5/6

A Member of the Triplex Foundries Group

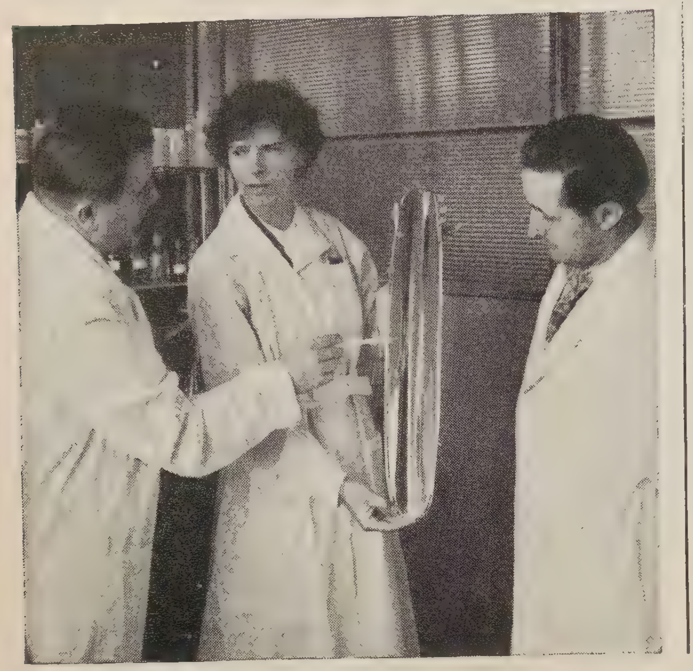
THE SIGN OF A GOOD CASTING

GF



Q88

ANODISING



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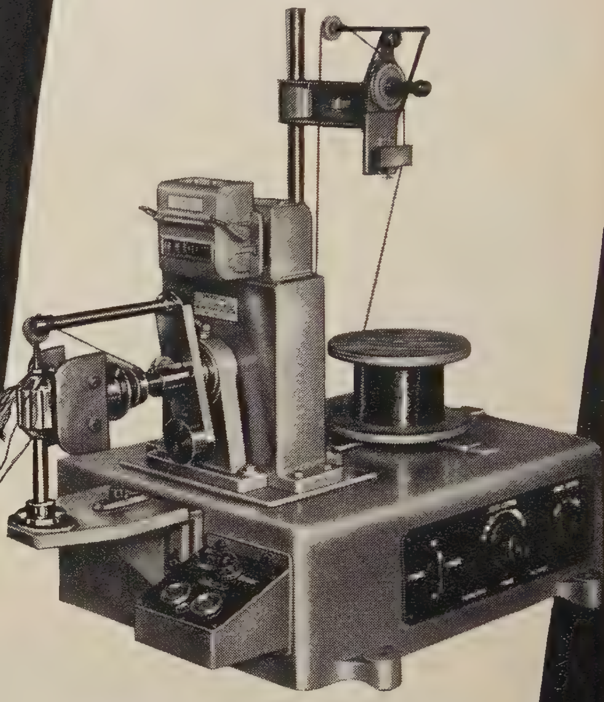

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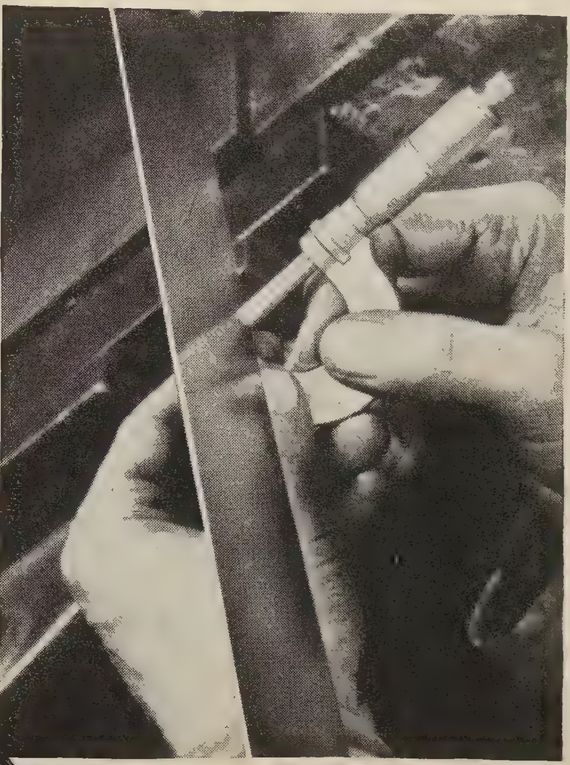

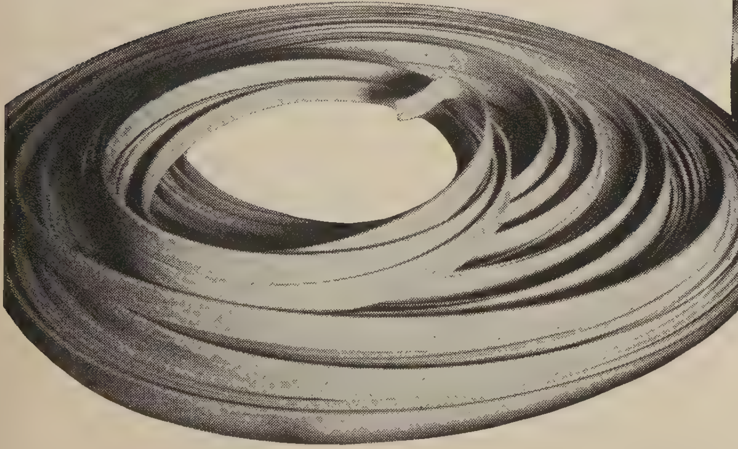

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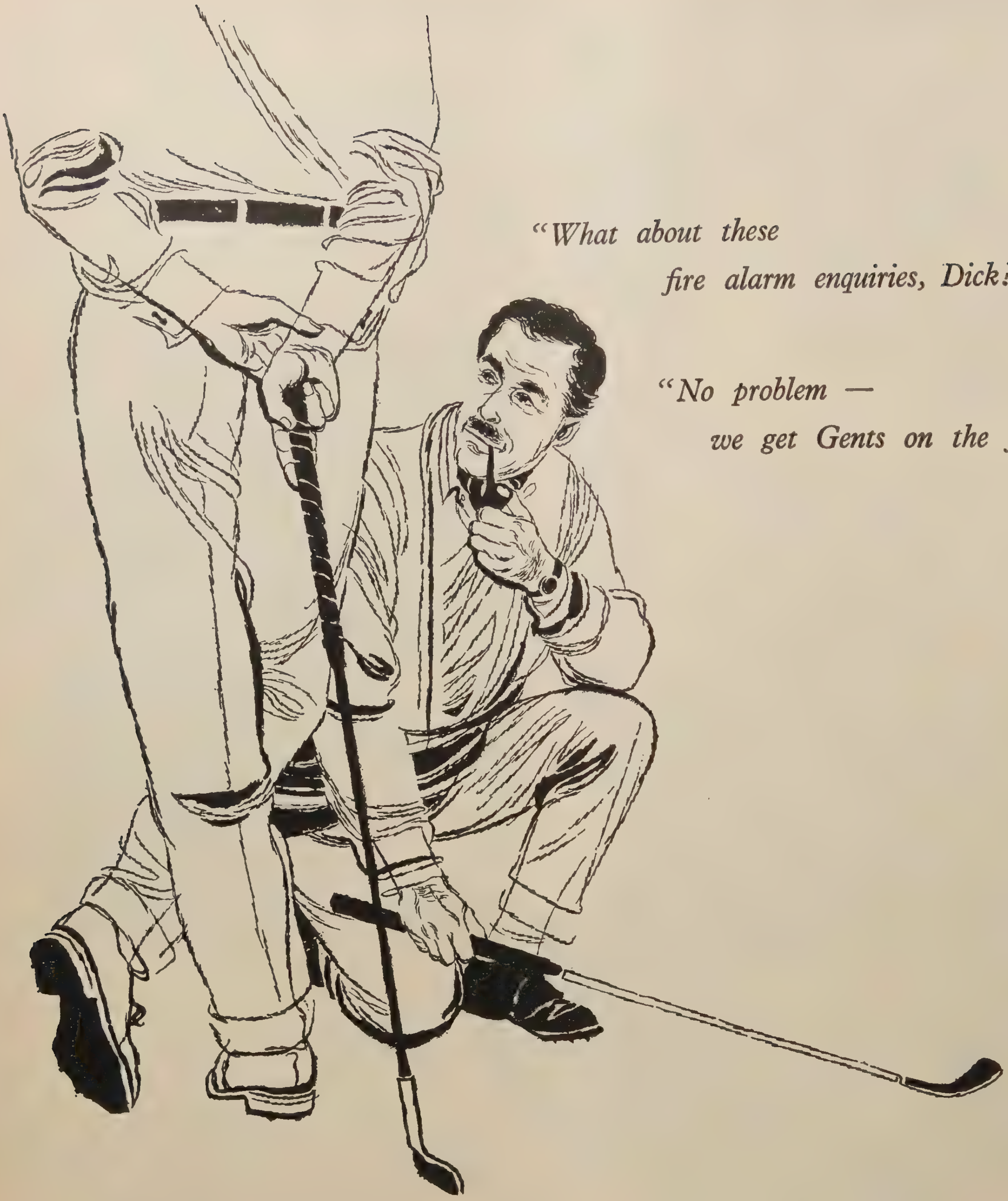
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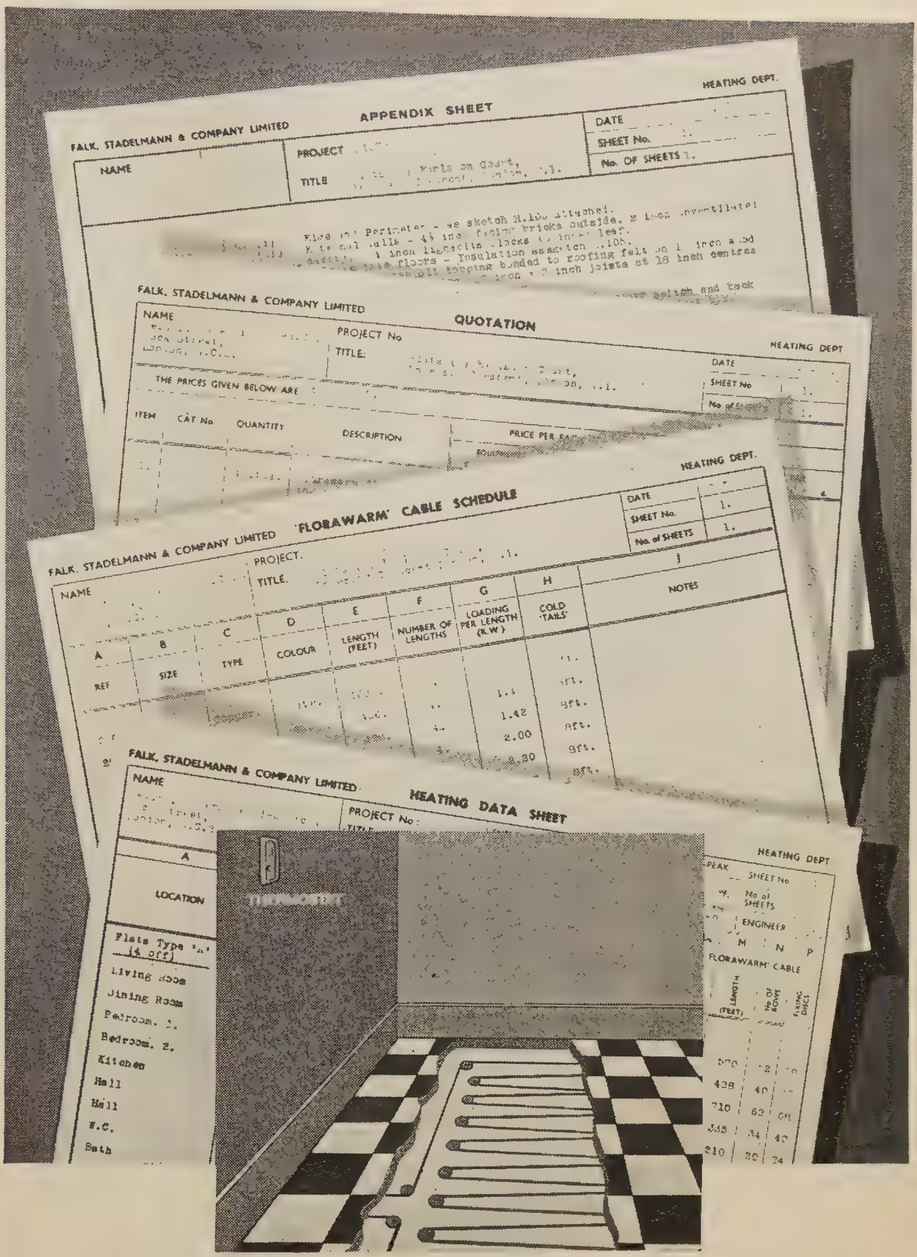
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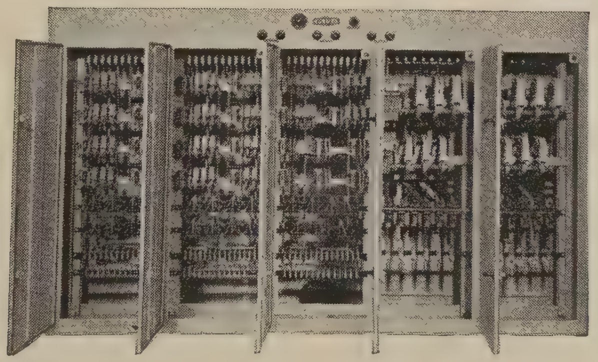

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A word leaking out in the wrong direction could upset years of work of design engineers. For a panel like this could double the output of canned soup, or increase foundry productivity. It could even be increasing the turnover of one of your competitors.

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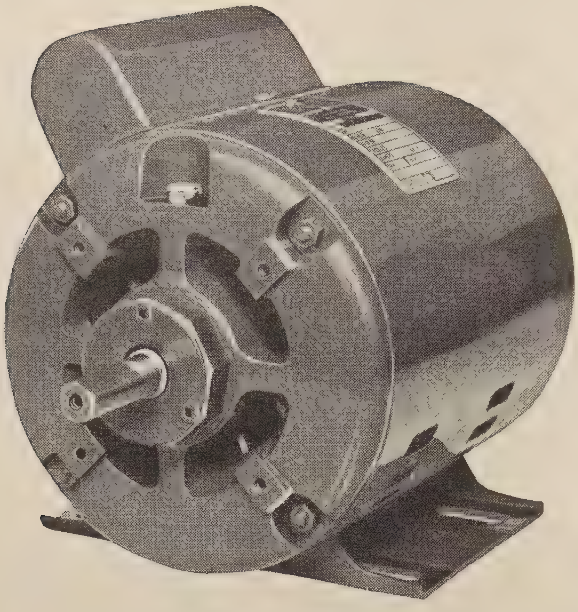
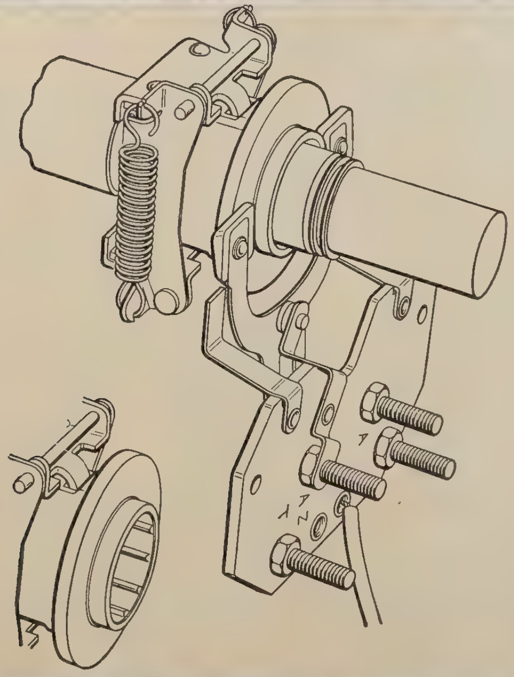


F.H.P. motors are not expensive machines yet they have to be extraordinarily robust and absolutely reliable—often with very little maintenance. Designing for this kind of reliability at a competitive price is far beyond the realms of text-book formulæ. The things that distinguish a really successful design are often details—but important ones—based on knowledge won the hard way; from years of making motors and servicing them in the conditions under which they run.

This thing called know-how



A detail of this kind is the centrifugal switch on our split-phase and capacitor-start motors. The problem with such switches is to derive a snap action on both opening and closing from an operating force that increases and decreases smoothly. In the switch shown here the restraining springs are so designed that their leverage decreases as the fly-weights open. Thus, increasing centrifugal force meets decreasing resistance and, at the set speed, wins outright; the collar snaps back smartly opening the contacts at the base of the yoke. On test, switches have snapped open and closed well over 1,000,000 times without failure—a level of reliability typical of the motors themselves.

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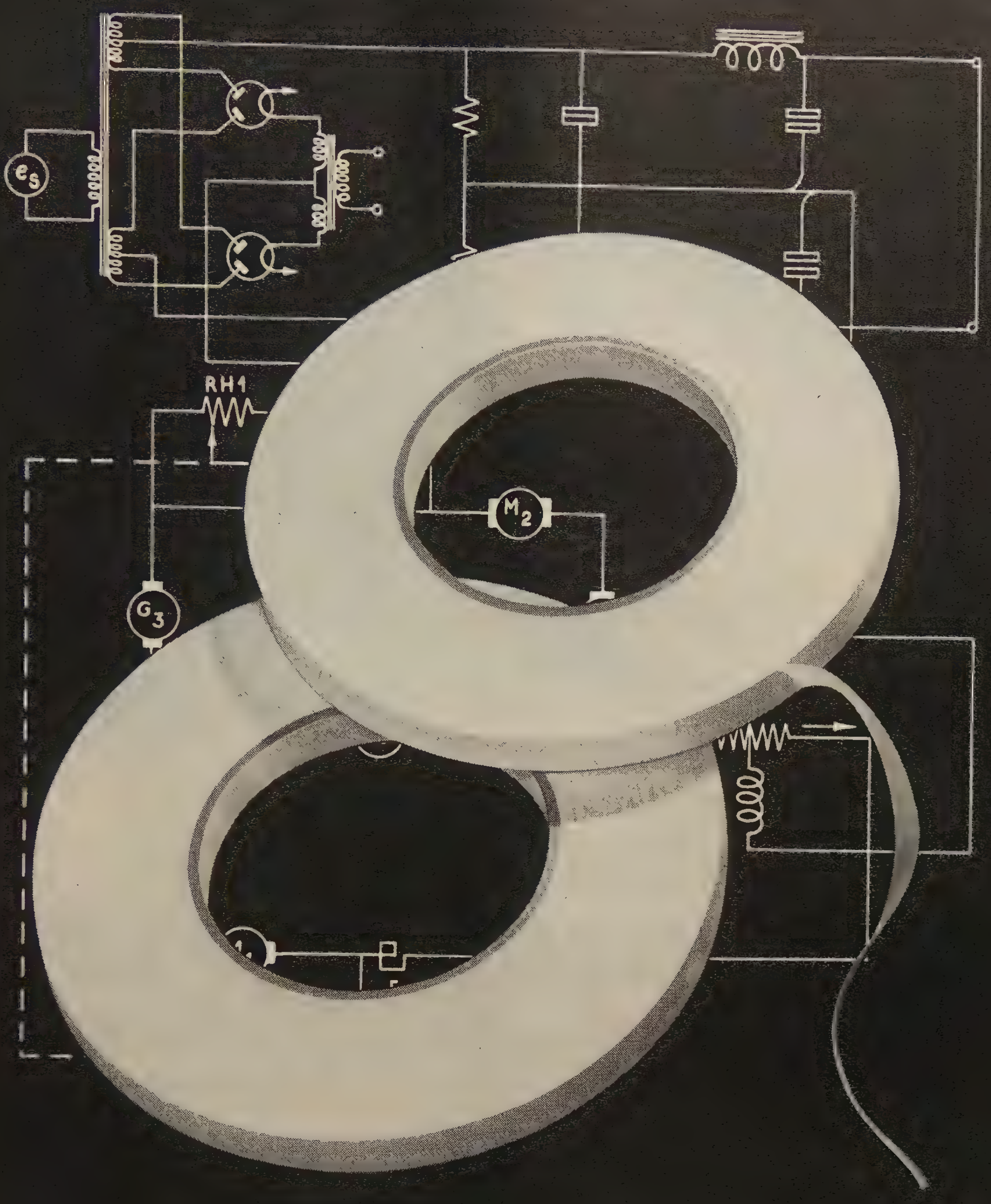

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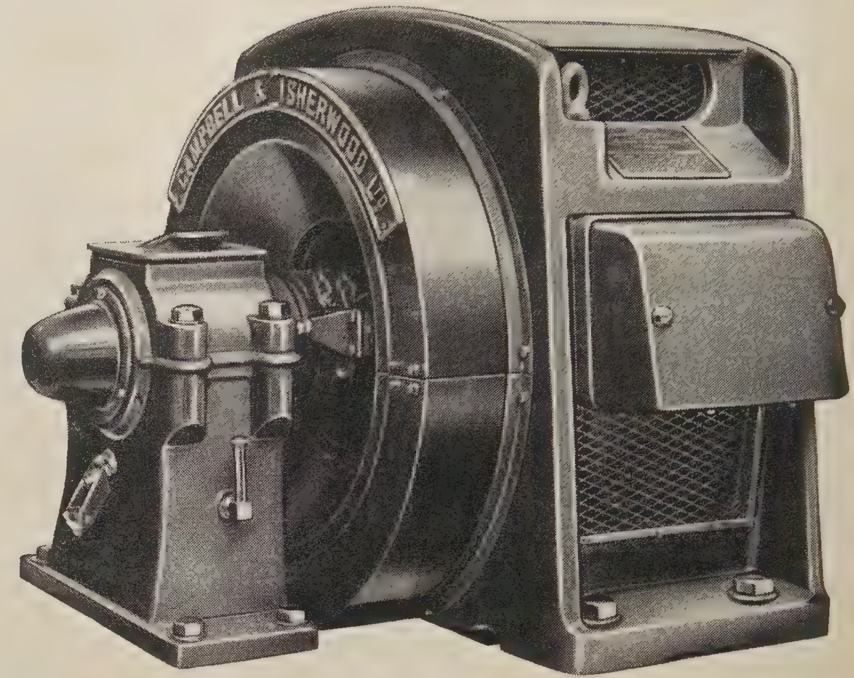

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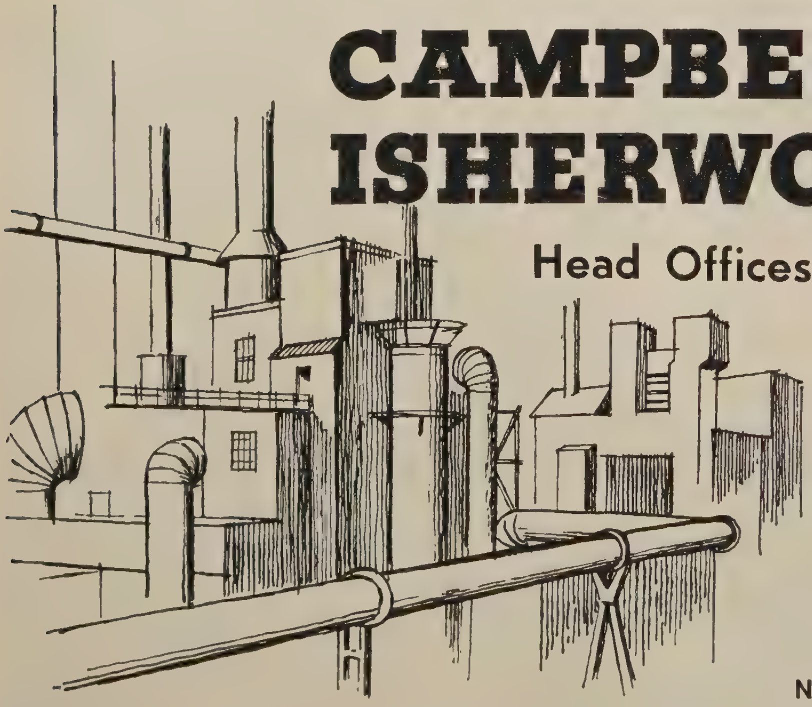

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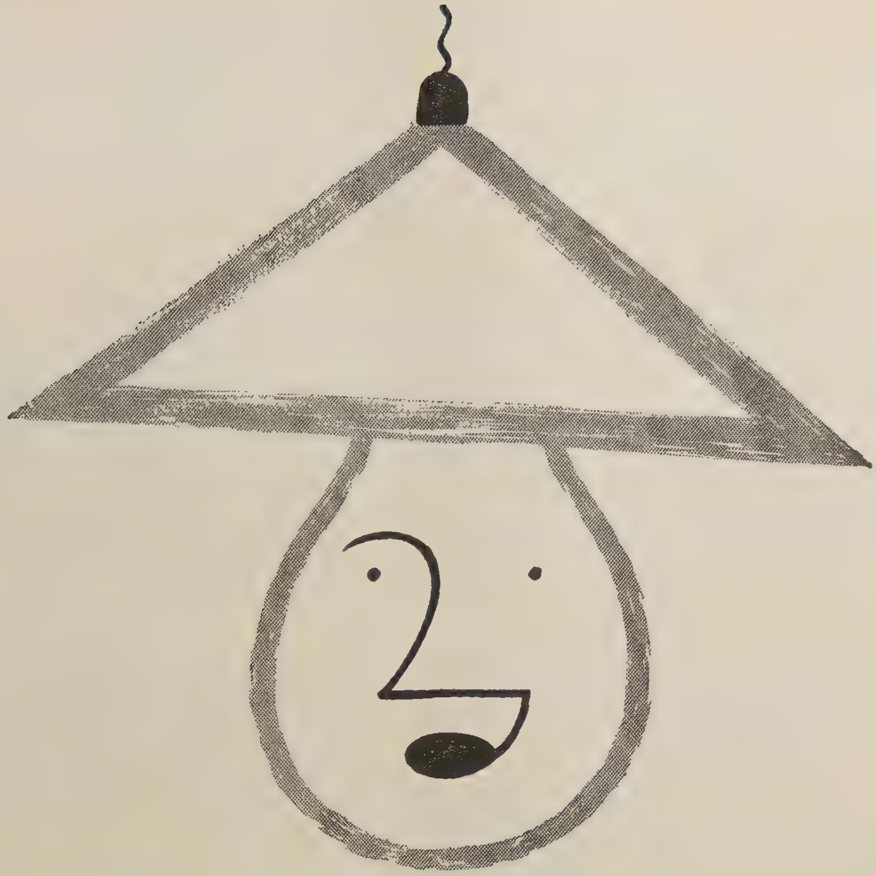

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I can't compete against sunlight, you know! In fact, I look so dim in daylight that they keep forgetting to switch me off. But I'm still bright enough to see that I'm wasting electricity! Why don't you fit a **SAVELITE?** Why not indeed? The 'Savelite' is a new photo-electric device which warns factory and office workers when to switch off unnecessary lights. Easily and cheaply installed in individual offices and workshops, it cuts electric light bills to the barest minimum, and saves its cost in a very short time.

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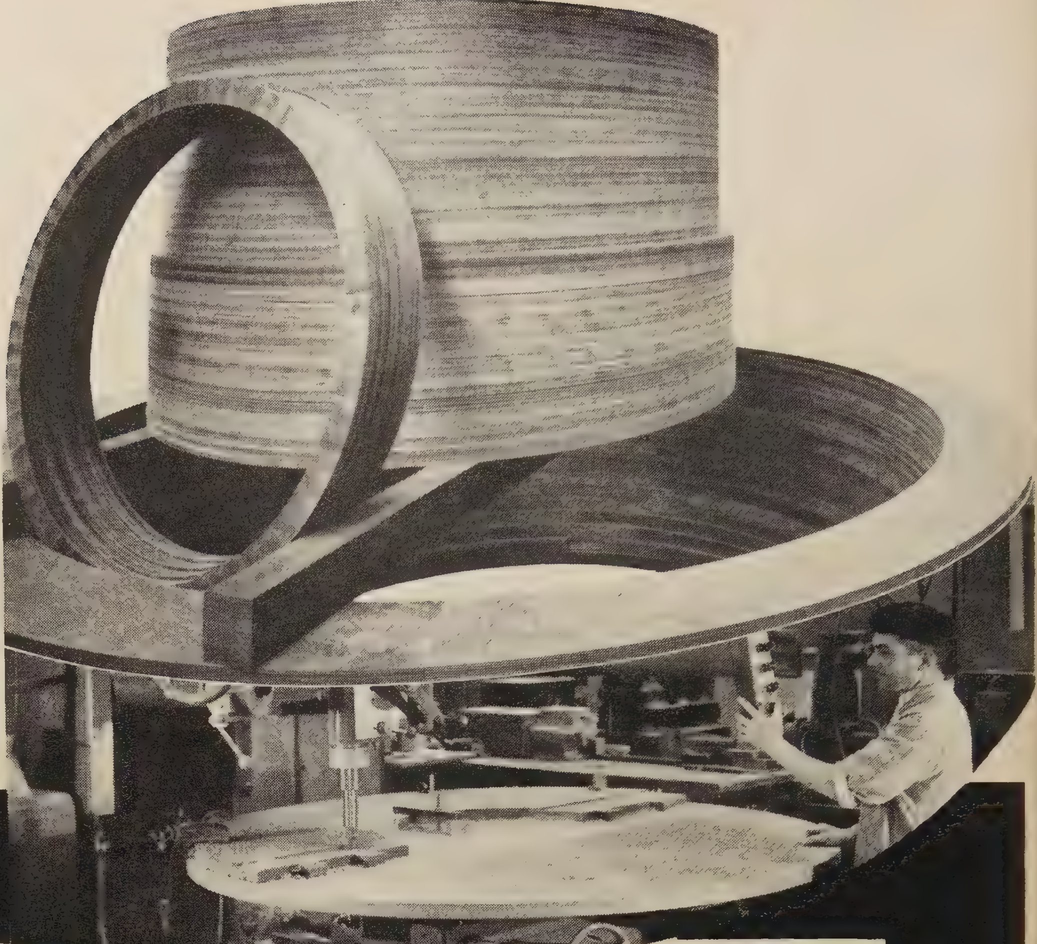

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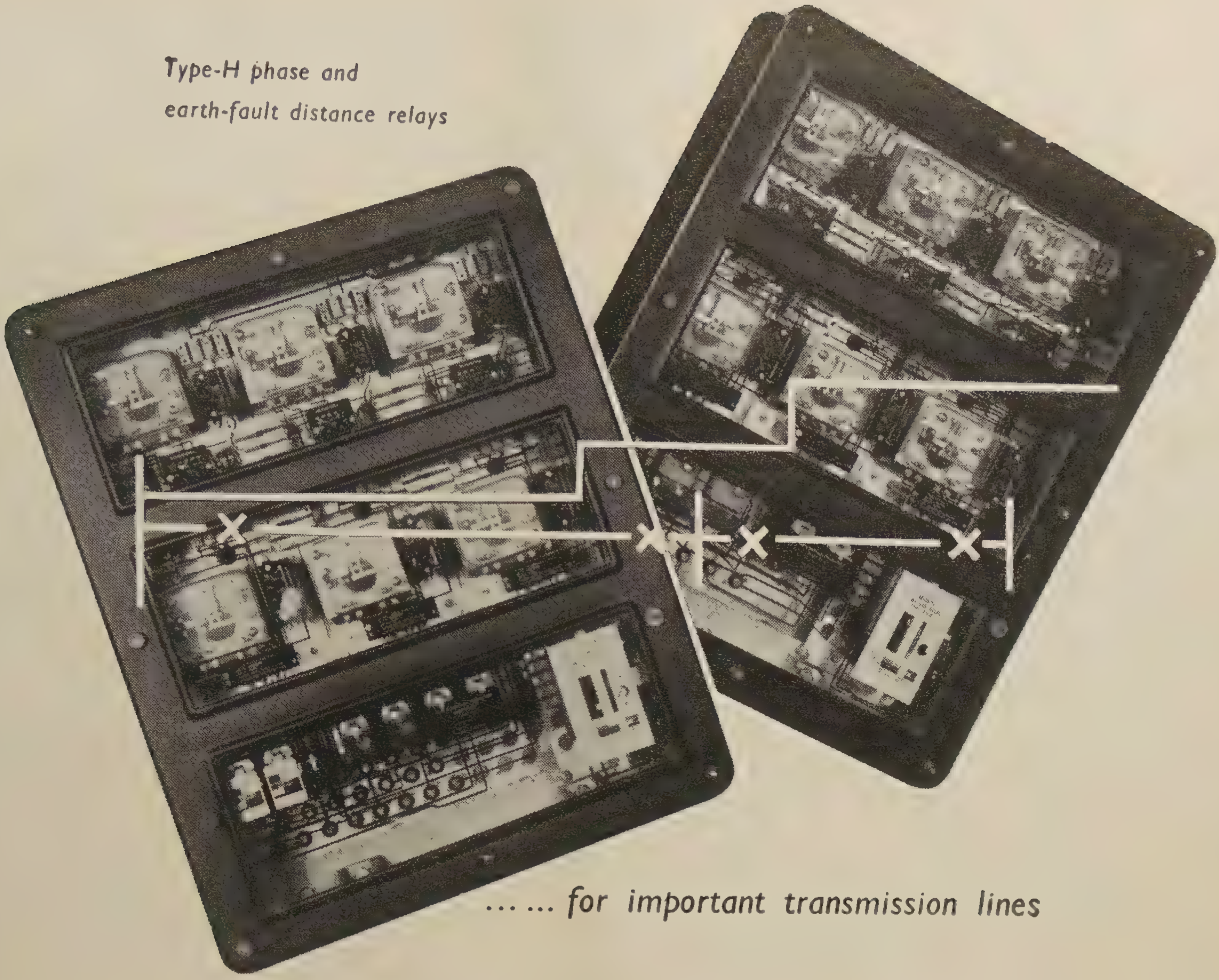

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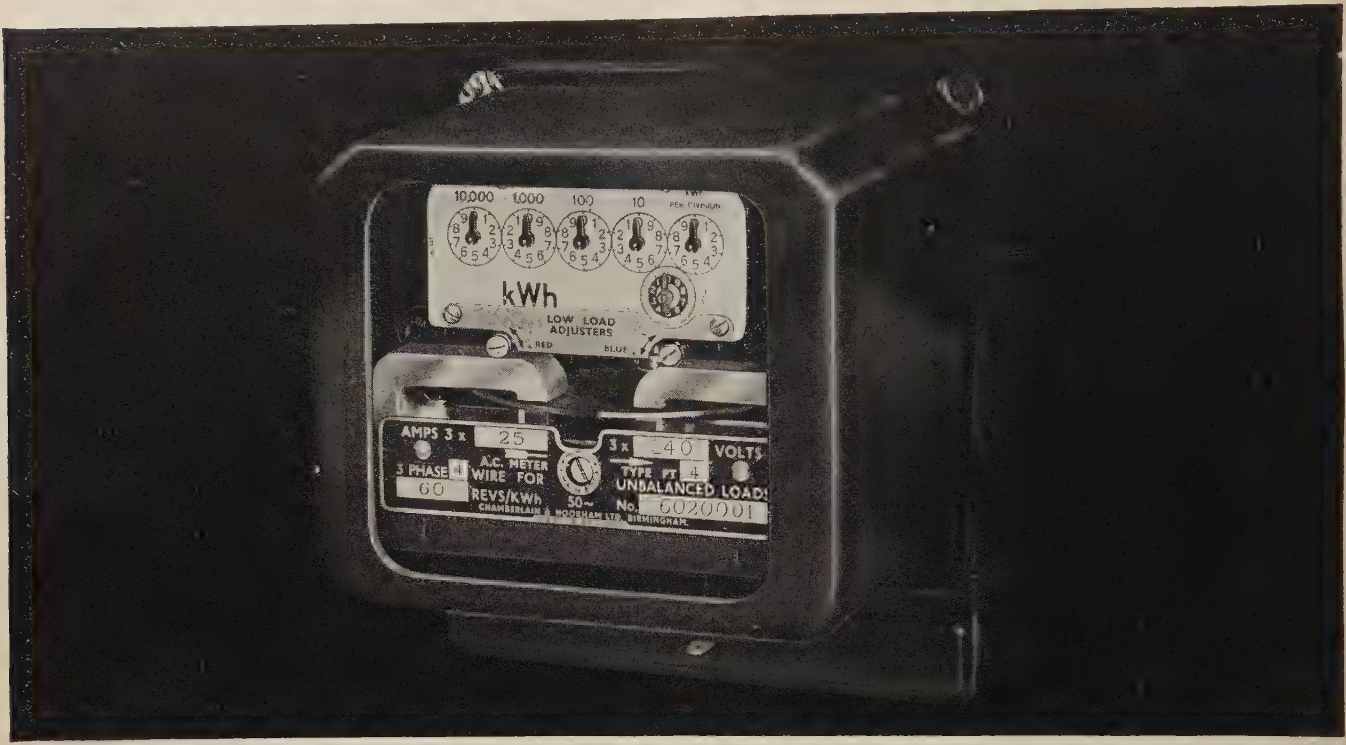
choose C.&H. meters

for high performance in a compact size



C. & H. *P series of meters in light alloy or all-insulated cases. PT 3-phase 3-wire. PT4 3-phase 4-wire. 5, 10, 25 and 50 amperes.*

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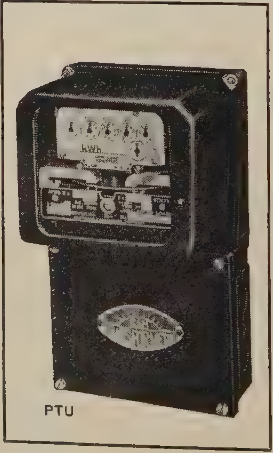
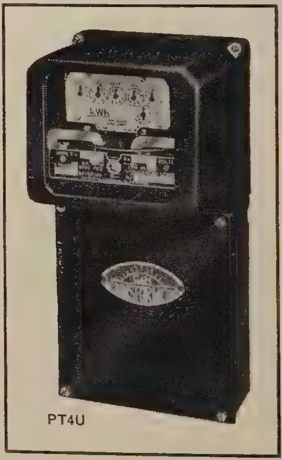


PTU



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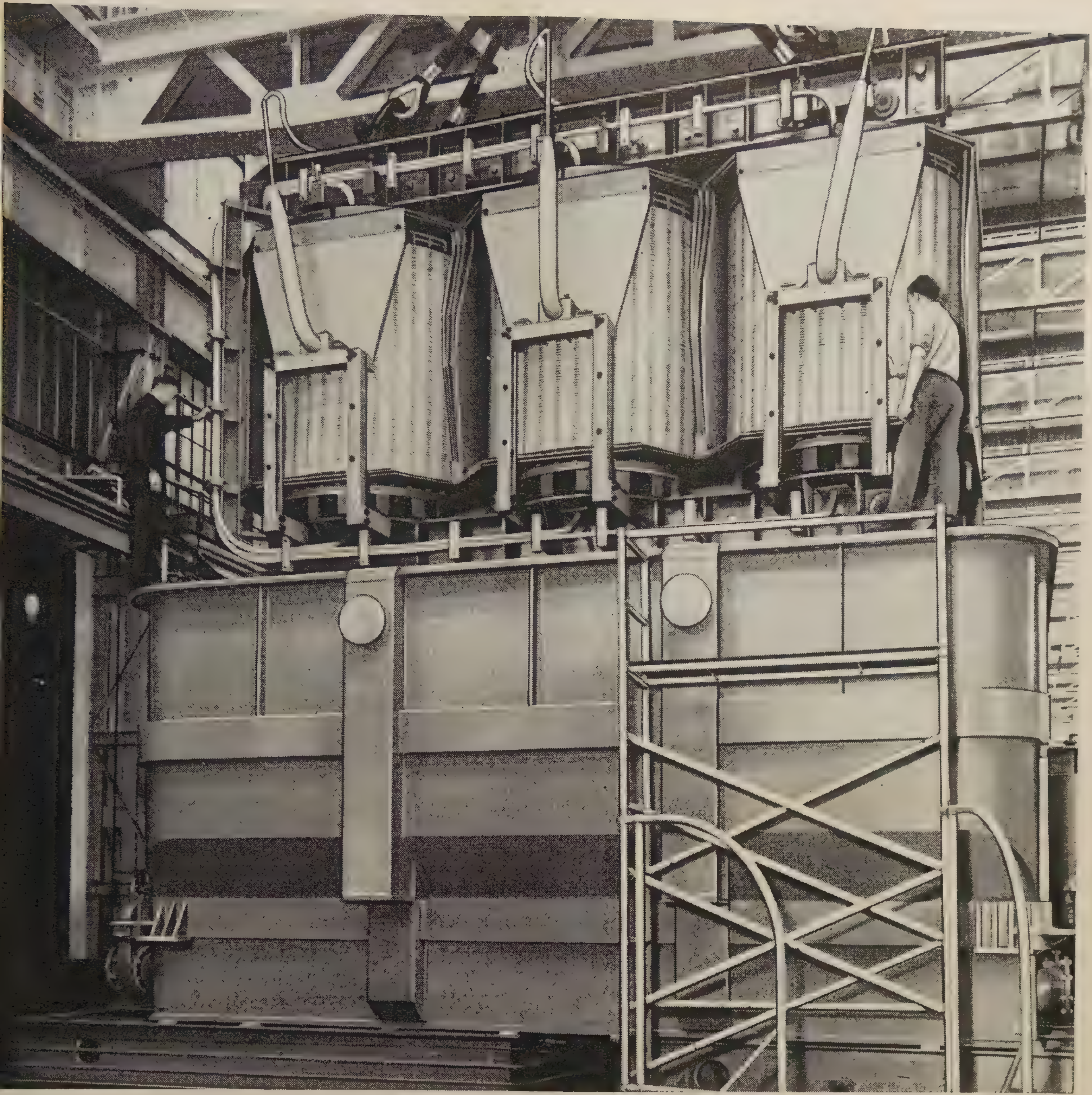

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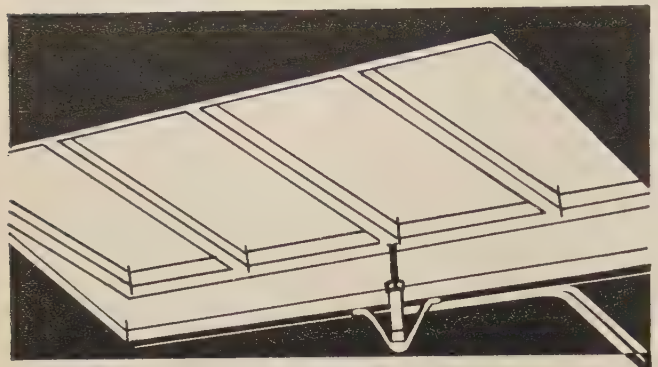

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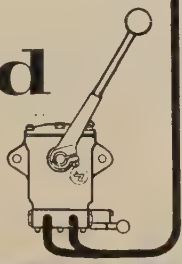

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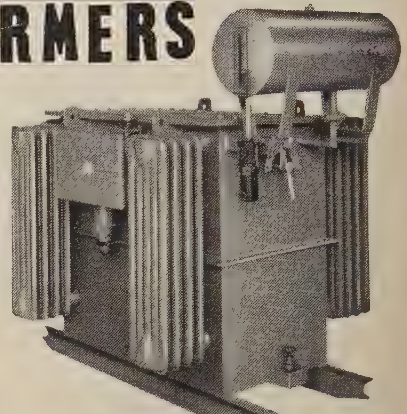

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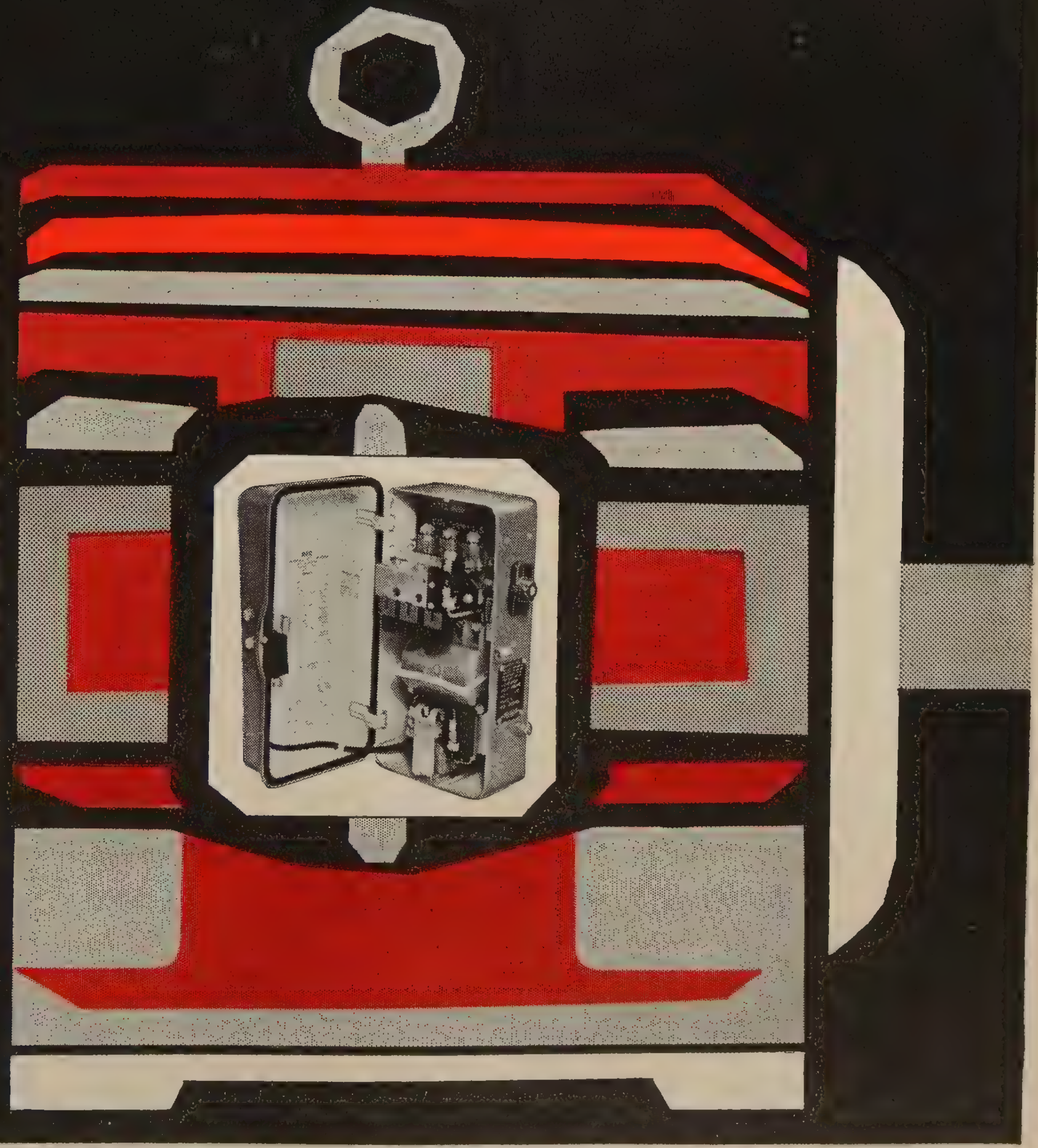

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B

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No matter how testing the working conditions, Class H motors will take the strain: you can safely subject your Class H motors to high humidity, scorching heat and heavy overloads. And it is often possible to choose a Class H motor of lower capacity than a Class A or B machine, because it is far more resistant to overload.

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Proved by tests: Continuous running tests have proved, that the insulation life of Class H motors outlasts both Class A and B insulation by *more than ten times.*

next time—try a Silicone Rewind

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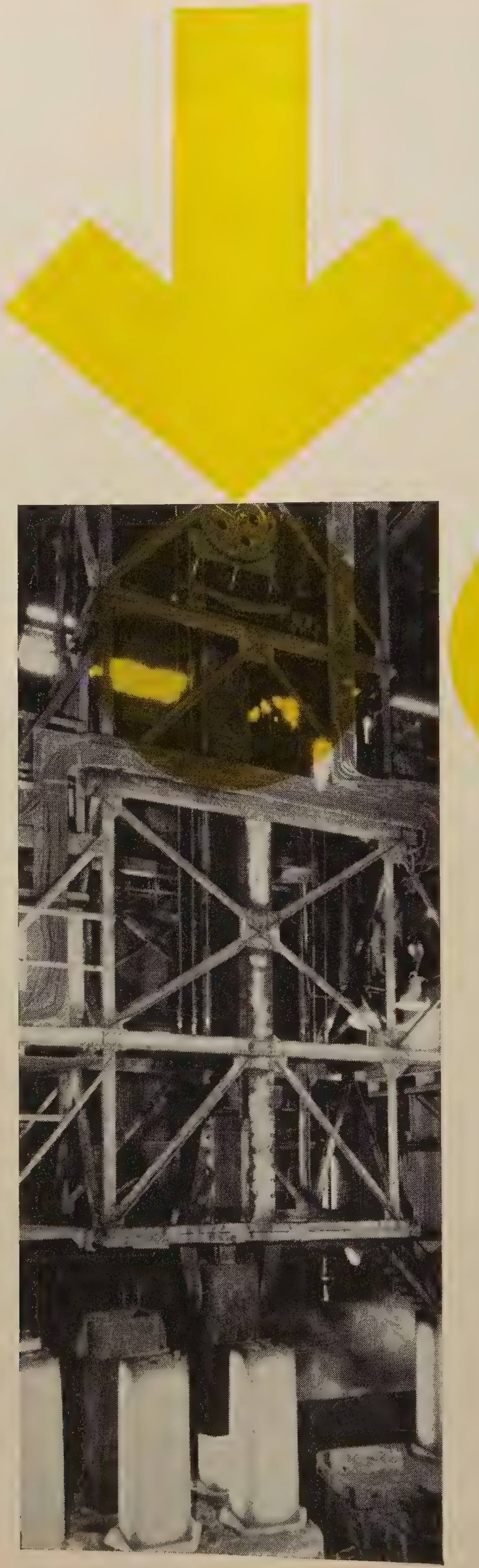

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£2,000 SAVED

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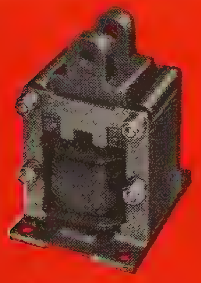

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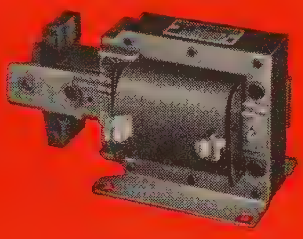

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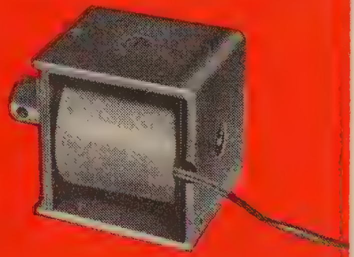

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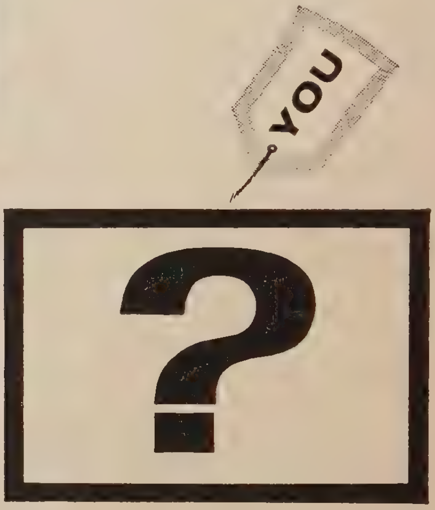

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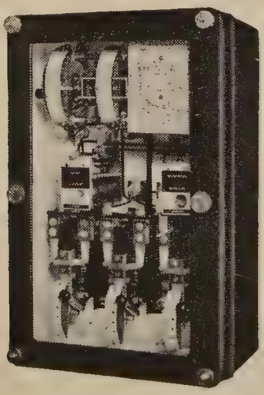

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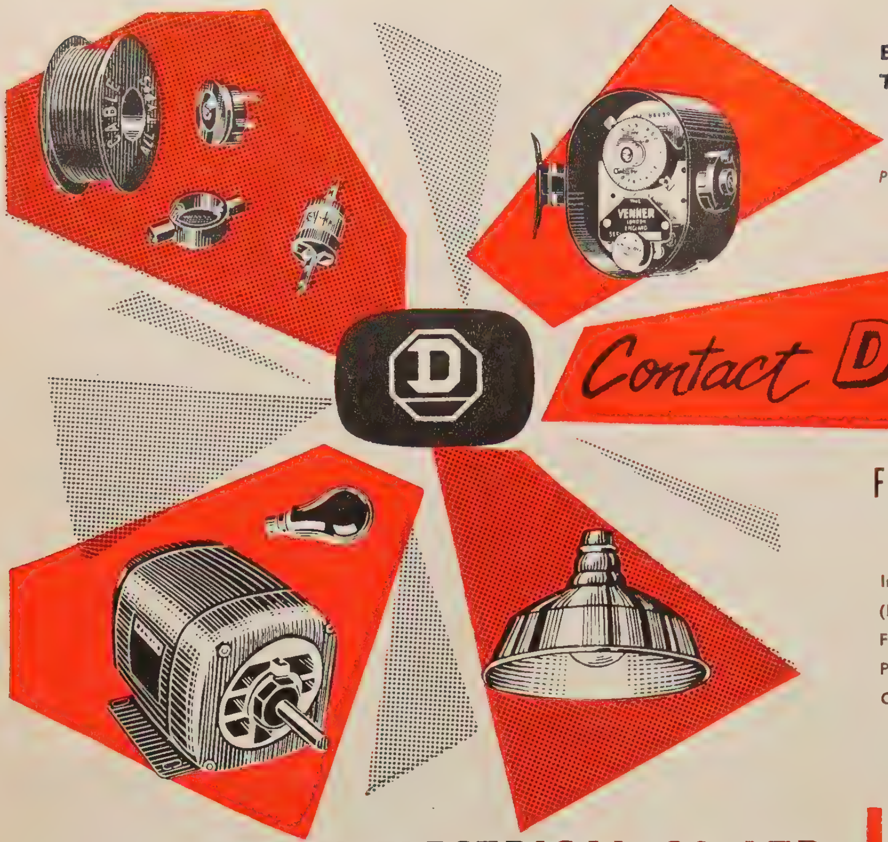

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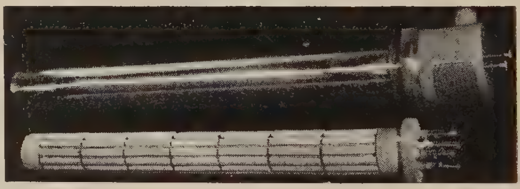

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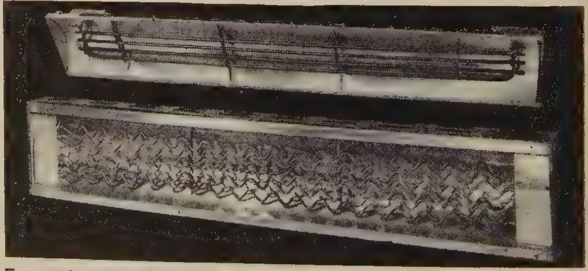

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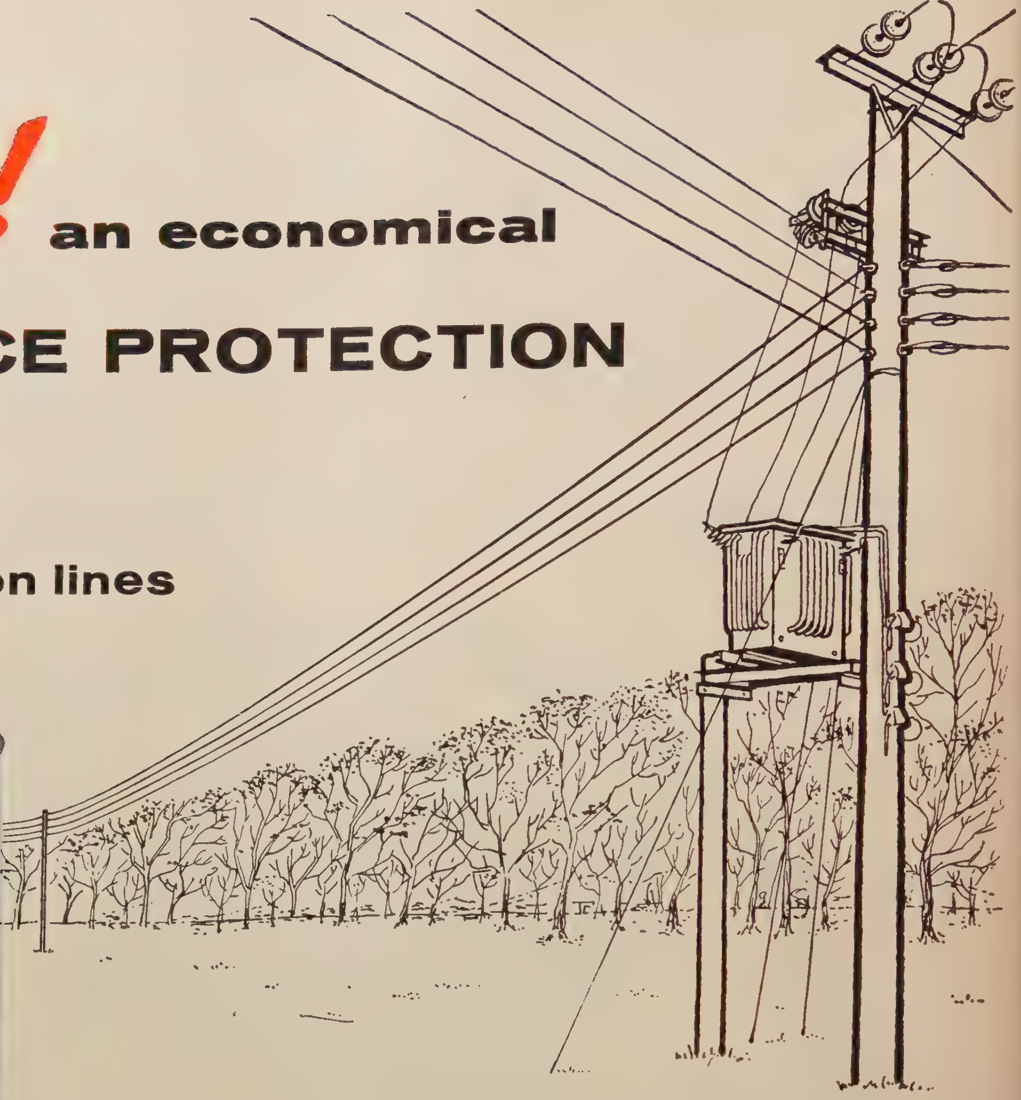

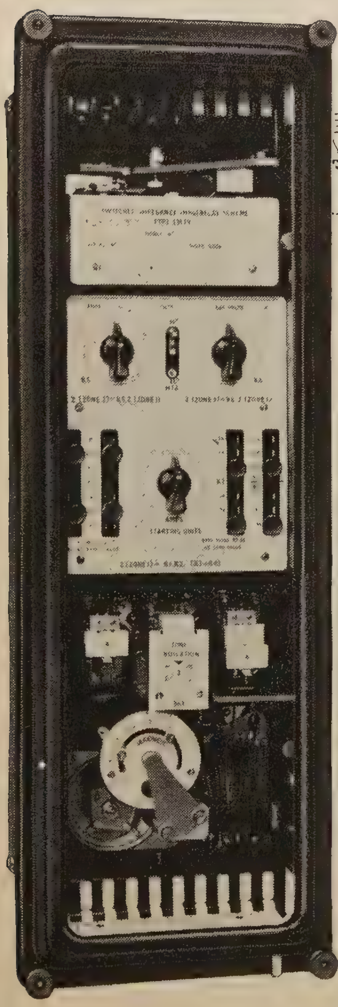

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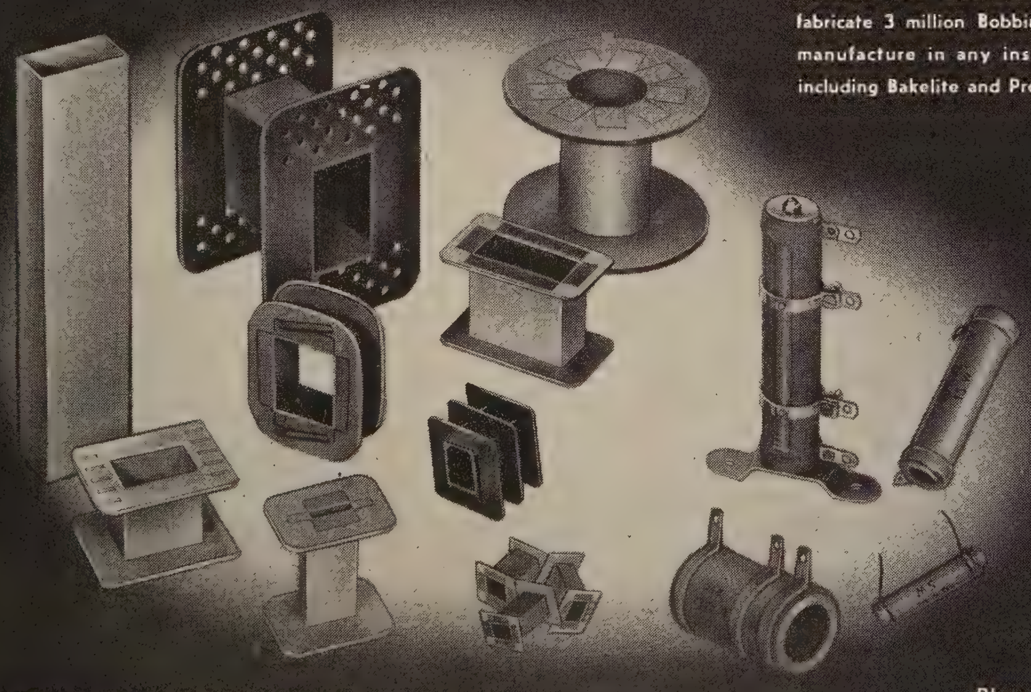

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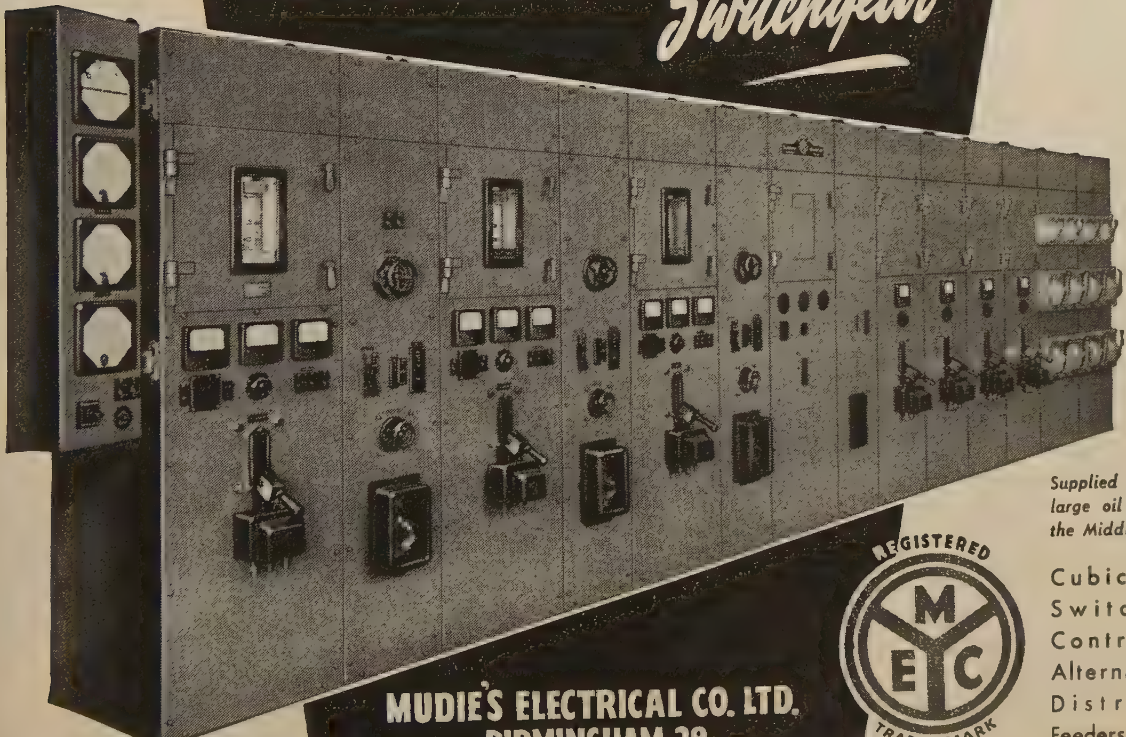

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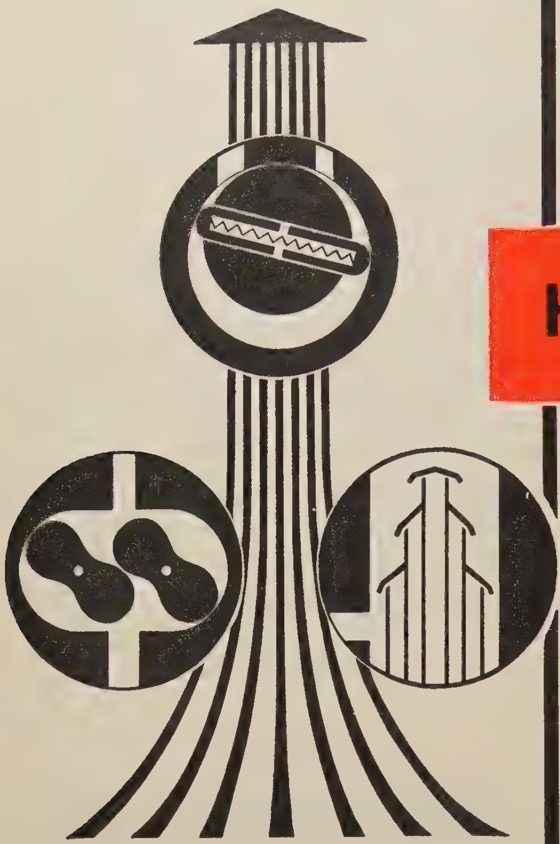

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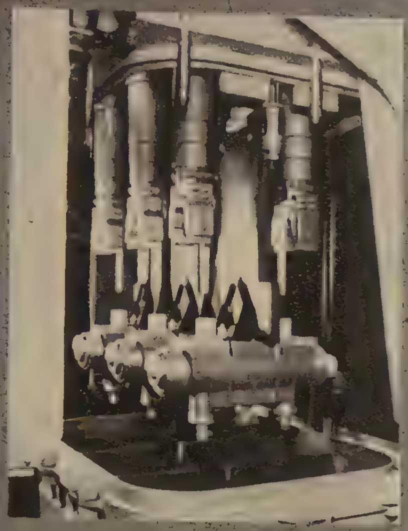

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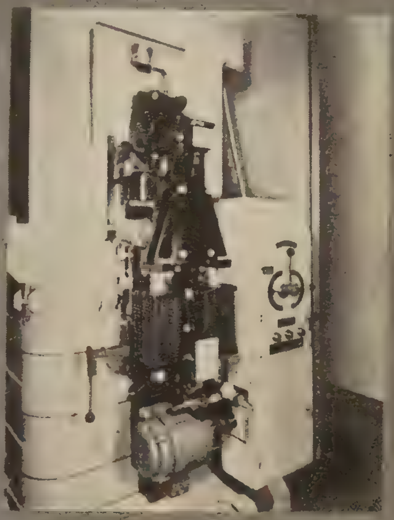

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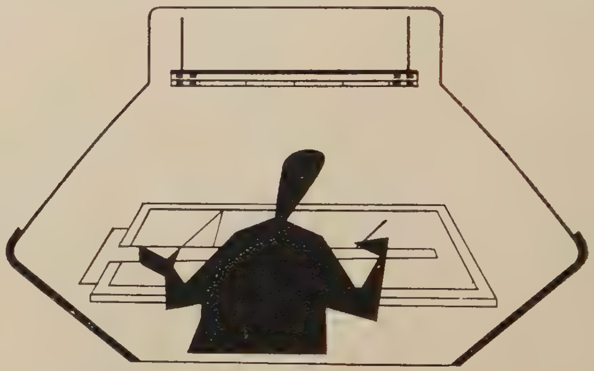

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Friday 10 November 1961 Volume 169 No 19

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IN THIS ISSUE

731 The Public Image

Much confusion exists as to the functions of the many organisations in the electricity supply industry. It is particularly important at a time when they are taking such a large share of the country's capital investment that the Electricity Boards should be regarded as an efficient and unified industry and their activities understood

733 Mechanical Forces in Magnetic and Electric Devices

Mr. P. Hammond, of Cambridge University Engineering Laboratory, describes a method of determining forces occurring in electromagnetic devices which makes use of the idea of field stresses

738 Wiring Regulations — Revision and Amendments

It is announced that the I.E.E. Wiring Regulations Committee has been authorised to proceed with the preparation of a 14th Edition of the Regulations. Users of the Regulations are invited to submit their comments on, or proposed amendments to, the present (13th) Edition by 1st January next

740 Short Circuit Ratings of Aluminium Cables

The author, Mr. A. G. Thomas (Alcan Industries, Ltd.) refers to the development work on short-circuit ratings carried out by Messrs. L. Gosland and R. G. Parr and predicts the probable behaviour of aluminium cables, based on the known properties of the metal

745 The Doncaster District

The development of the Doncaster District of the Yorkshire Electricity Board since nationalisation of the electricity supply industry is surveyed by the district manager, Mr. J. L. Ferns

761 Electric Shock Treatment

Views on artificial respiration methods expressed by Dr. H. J. Gilbert in an article reproduced from the staff magazine of the North Eastern Electricity Board and the C.E.G.B. North Eastern Division

762 Circuit Protection and Control

Modern methods of circuit protection were reviewed by Mr. J. A. Robbins, of J. A. Crabtree & Co., Ltd., last week at meetings attended by nearly 1,500 consultants, contractors, architects and others

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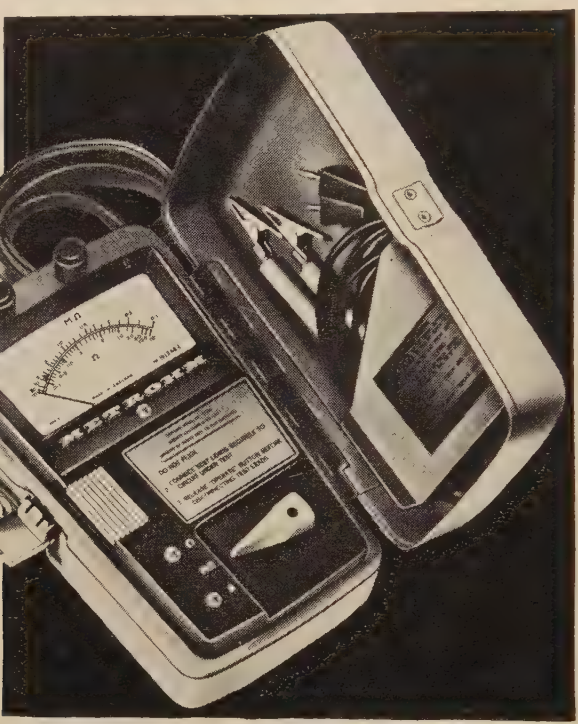

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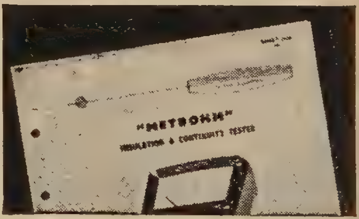

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ELECTRICAL REVIEW

10 November 1961 Vol. 169 No. 19 Established 1872

The Public Image

THE electricity supply industry has an enormous appetite for capital. In the coming financial year, 1962-63, the Electricity Boards in England and Wales and the two Scottish Boards have Government approval to spend nearly £400 million on fixed assets and nuclear fuel. This is 10 per cent more than the industry expects to spend this year and over a fifth of the country's total investment in the public sector.

The new plant and equipment which the electricity supply industry increasingly needs to meet its obligations is a measure of the importance of electricity in the economic life of the country. But this may easily be forgotten when public attention is concentrated on the large sums of money involved and these are compared with the many other pressing demands for investment in a country where capital has been scarce and expensive.

This is just one good reason, and there are many others, why the Electricity Boards should make sure that they are seen as an efficient and unified industry. Unfortunately the public image of the electricity supply industry is hopelessly confused. This is partly due to the several upheavals in organisation and partly to the many bodies that claim to speak on supply matters. How many consumers know who fixes the price of their electricity or that they, and not the Government, finance the industry's development? That there is no central office in London where information can be obtained on the whole industry, reinforces an outsider's unwarranted impression of disorganisation. The industry's own publicity does not help and has even created some internal dissension.

The C.E.G.B. at least have appreciated the value of building up by expert public relations a " well-informed public and parliamentary opinion," although, ironically, they have no direct dealings with the public. But this is only one side of the industry's activities and there must be reservations about the false idea of the Board's dominant position that is implied. Many people in the industry would also question the wisdom of the wide publicity obtained in the lay Press for the bulk supply tariff. Since retail tariffs are not immediately affected, the relationship between Area Boards and their consumers tends to be undermined by this announcement of wholesale prices. The emphasis on generation, with its high levels of capital expenditure, also distorts the trade unions' view of the industry's " ability to pay."

The answer is to create a more balanced and co-ordinated picture of the industry's development. Any apologia for the industry's intrusion on amenities should be matched by a no less forceful advertising and public relations effort on, say, the advantages of developing a balanced load. Since all sections of the industry are affected in varying degrees by these problems, such publicity would best be handled centrally. Under the Electricity Act the Electricity Council has the duty " to promote and assist the maintenance and development by Electricity Boards in England and Wales of an efficient, co-ordinated and economical system of electricity supply." This implies a more active rôle than the Council have seemed willing to adopt.

BETTER OFFICE LIGHTING

Opposition members were justly indignant at the Government's decision not to do anything about the Offices Act, 1960, a private member's measure introduced by Mr. Richard Marsh (Labour). The Act, which was to have come into force on 1st January next, enabled the Home Secretary to make regulations governing conditions of employment in offices, i.e., accommodation, ventilation, heating and lighting. It was the Government's announced intention to supplant the Act during the current session of Parliament by one of its own of a more comprehensive character covering—in addition to offices—shops and railway establishments. Because of congestion in the legislative programme, the Government says, it is not yet possible to proceed with this measure.

In the meantime, in anticipation of the issue of regulations under Mr. Marsh's Act, the British Lighting Council has been conducting an office lighting campaign and this has been backed by the appropriate sections of the electrical industry, including the Electrical Contractors' Association. Pamphlets have asked those responsible for selling and installing lighting " Are You ready for January 1st, 1962? " on the assumption that regulations would be promulgated by that date. Now the date means nothing, but that is not to say that the propaganda has been in vain. With or without regulations, those responsible for bad office lighting should be made to realise their shortcomings and be persuaded to do better for their employees. And so the campaign will go on.

SHOCK TREATMENT METHODS

Considerable interest has recently been aroused in the possibility of using the mouth-to-mouth method of artificial respiration in cases of electric shock. This follows the publicity given to its inclusion in the training syllabuses of such organisations as the Royal Life Saving Society, the British Red Cross Society, the St. John and St. Andrew's Ambulance Associations and the British Safety Council, although the last-named has expressed a preference for the mouth-to-nose technique. Opinion in the medical profession as to its suitability for universal application is not, however, unanimous and we are accordingly publishing in this issue (page 761) an article expressing the views of Dr. Herald J. Gilbert, M.B., B.S. This has been reproduced from *The Nor'-Easter*—the staff magazine of the North Eastern Electricity Board and the North Eastern Division of the C.E.G.B.—by kind permission of the editor.

Support is lent to Dr. Gilbert's opinion by the British Medical Association, who consider that in cases where untrained people are endeavouring to save life simply by following instructions on a wall chart, there is much to commend the Holger Nielsen method, or the use of a rocking stretcher if this is immediately available. The Association, however, approve the oral method provided it is carried out by trained personnel by whom it is thoroughly understood. Since training will soon begin on a large scale we shall shortly publish an illustrated description of the method, suitable for attaching to our existing wall charts dealing with electric shock treatment, so that either method can be used according to the training of the rescuer.

DEFECTIVE APPLIANCES

It might be thought that mass-produced articles should be identical in construction, finish and operation. But, of course, apart from variations in material, the " human element " is generally present and uniformity cannot be guaranteed. This probably explains the frequent complaints made about equipment and appliances, including the electrical kind. Recently the Southern Electricity Consultative Council has had grumbles from customers who, having bought appliances from the Southern Board's service centres, have had to return them soon afterwards for various reasons.

As a result the Board is said by the *Southern Evening Echo* to be " taking action at national level to urge manufacturers to improve the position by adequate testing and inspection before dispatch." Most manufacturers will contend that their testing and inspection methods are already adequate but that with the best will in the world they cannot prevent occasional negligence by their employees. They realise that their reputation is damaged by defective appliances bearing their names and act accordingly. There are also the possibilities of damage after the equipment leaves the factory or misuse by the customer.

NUCLEAR POWER

Next week's *Electrical Review* (17th November) will contain a survey of nuclear power development in Great Britain. The main feature will be a description of the advanced gas-cooled reactor (A.G.R.) with a fold-out drawing in colour showing the construction and operation. Sir William Cook, of the U.K. Atomic Energy Authority, deals with the present situation and future possibilities and other articles discuss the design concept of the A.G.R. and the position of nuclear power in the general programme of power station construction

Mechanical Forces in Magnetic and Electric Devices

A SIMPLE METHOD OF CALCULATION

The sound understanding of the relationship between electrical and mechanical forces needed by designers of such diverse apparatus as rotating machines, lifting magnets, and circuit-breakers can be achieved by the concept of field stresses

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ONE of the most important questions facing an electrical design engineer is how to determine the mechanical forces acting on the various parts of his apparatus. Examples that spring to mind in support of this statement are, first, all the devices that convert electrical into mechanical energy such as rotating machines, selsyns and lifting magnets. But the statement is also true for moving pointer instruments, electric bells, circuit-breakers and contactors, loudspeaker coils and in fact all moving devices. Even in stationary apparatus such as busbars, transformers, reactors and capacitors the designer has to satisfy himself that the structure of the apparatus is sufficiently rigid to withstand the mechanical forces which inevitably accompany electric and magnetic phenomena.

Realising the importance of the subject, a young design engineer would reasonably expect that methods of calculating mechanical forces are well understood and constantly used, but he will slowly discover that in fact the position is far less satisfactory. This discovery will come from conversation with experienced engineers and from searching through the literature. Textbooks especially are most disappointing and it is not unusual to find that a recent graduate in electrical engineering is almost completely unaware of the existence of mechanical forces, although his ability in analysing circuits is considerable. The only problem he will tackle with any confidence is that of a simple horseshoe lifting magnet and even in this problem he is likely to be unable to distinguish between the forces on a permanent magnet and those on the winding and core of an electromagnet. Teachers of electrical engineering might well re-examine the traditional rigid separation between electrical and mechanical subjects.

In nature, there is no such separation and it is at least doubtful whether a student gains anything from having his thinking departmentalised in this way. It is thoughts such as these that underlie this article and it is perhaps worth saying that the author has experience both as an industrial designer and a university teacher. It is proposed to put forward in this article a simple method of calculating mechanical forces. We shall first of all examine the basis of the method in a section dealing with fundamental ideas. This section might well be omitted by readers who wish to proceed at once to the application of the method in the remainder of the article. The method itself is due to the famous James Clerk Maxwell (c. 1870); what is new in this article is the method of presentation of the method in a manner which can be understood more easily than Maxwell's original treatment, which was based on speculations about an all-pervading "æther" and was presented in a very mathematical form.

Fundamental Ideas

The fundamental idea in electricity is that of electric charge. Charge is a property of matter in the same sense as mass is a property of matter. Both mass and charge are defined in terms of a force of interaction and in both cases the force of interaction varies as the inverse square of the distance. Charge is thus defined as that which acts upon a similar thing with an inverse square law of force. The notion of force is built into the definition of what we mean by charge and the force on any charged body can be calculated in principle by vector addition of forces. However, such a process is likely to be very cumbersome.

We may be interested in the force on a particular charged body due to charges distributed in a very complicated manner. Instead of proceeding at once to calculate the interaction forces between the charges, we find it more convenient to invent the concept of electric field strength and proceed to calculate the forces in two steps as follows:—Let there be two charges, A and B. Instead of finding the force of interaction directly, we replace charge A by its field C at charge B and calculate the force by letting C act on B.

The force on B can thus be calculated, and we can consider that the equal and opposite reaction by charge B on charge A acts on the field C and is transmitted by the field to the charge A. This does not imply that the force is actually felt by the field C. Such a statement would be meaningless, since the field does not consist of matter and therefore cannot measure force. But it does mean that we can calculate the total force on A without having to know the location and strength of A.

There is a further step we can take. Suppose we know neither the location and strength of A, nor the location and strength of B. Can we find the force on A or B purely from a knowledge of the electric field strength? The answer is that we can as long as we can investigate the field over a closed surface which completely encloses the charge A or the charge B. This important conclusion is a consequence of the inverse square law of force and we shall examine it more closely later in this article. In the meantime we note that the concept of electric field has presented us with a powerful new tool. The total force on a collection of charges can be calculated by selecting an arbitrary closed surface surrounding the charges and by working out the "force on the field" at this surface. We shall give examples of this method later.

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The fundamental concept in magnetism is the magnetic dipole or small current loop. The force of interaction varies as the inverse cube of the distance. It would be very convenient if the law could be that of the inverse square. This is achieved if the action is attributed to magnetic poles instead of dipoles. Since the dipole is the fundamental entity it must always be remembered that poles occur in pairs. Apart from this, the discussion for electric charges holds exactly for magnetic poles. The fact that the effects of magnetic dipoles and small current loops are indistinguishable at a distance means that the interaction of steady currents can be dealt with by identical mathematics as the interaction of stationary charges. This is a great saving of mental energy.

The inverse square law of force applies only to static electric and magnetic fields. In more general problems involving moving charges in arbitrary motion, it is impossible to determine the forces on charges by using the auxiliary concept of electric and magnetic fields. The reason for this lies in the fact that electromagnetic effects are propagated with finite velocity. The force on charge B depends on the position and velocity of charge A at a previous instant and these facts may not be known. Instantaneous action and reaction between two charges has no meaning in such circumstances and it becomes very desirable to express the problem in relativistic terms.

If, however, the charges and currents are oscillatory, it is possible to calculate the *average* forces upon them. In such cases, the concept of an electromagnetic field can be used with great advantage and the reaction force can again be said to act on this field. As in the static case, it is therefore unnecessary to know the position and strength of the charges and currents. All that is necessary is that the electromagnetic field should be known over any closed surface which completely envelops the charges and currents. The truth of this statement can be proved by Poynting's theorem. A detailed discussion is outside the scope of this article which is primarily concerned with static electric and magnetic fields. We shall confine ourselves to one simple example of the method as applied to oscillatory fields.

Method of Calculation

We have seen that by inventing the concepts of electric and magnetic fields we can calculate the force on a body as long as the field is known over any arbitrary surface enclosing the body. Consider then an arbitrary electrostatic field. Because of the inverse square law (or Gauss's theorem) the field can be described by tubes of electric flux which start and finish on a surface carrying electric charge. In a magnetostatic field, tubes of magnetic flux can be drawn in a similar manner. Since there are no free magnetic poles, such tubes are continuous and do not start or end anywhere. As previously mentioned, however, it is often convenient to attribute magnetic effects to poles rather than to dipoles. In that case tubes of magnetic flux start and finish on the surface carrying magnetic pole strength. Fig. 1 can be thus applied to the magnetic case as long as the total surface pole strength is zero on both A and B.

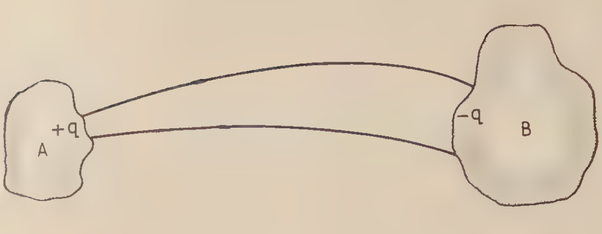


Fig. 1.—Electric or magnetic flux between two bodies A and B

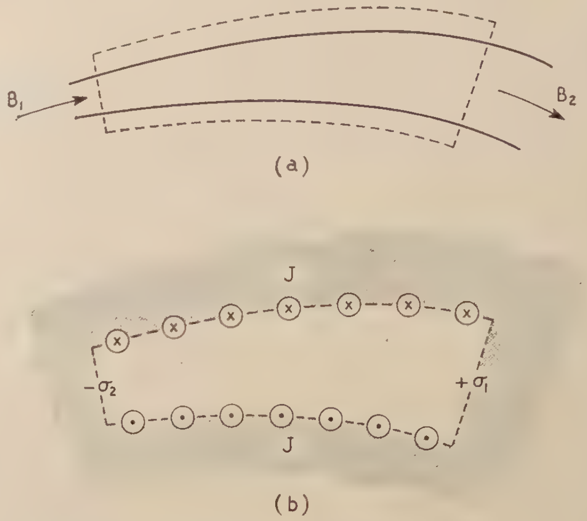


Fig. 2.—Portion of the flux tube shown in Fig. 1 with (a) membrane surrounding it and (b) disposition of electric currents and magnetic strengths required to cancel the field inside the flux tube

Consider now a portion of such a tube of flux in empty space. We wish to calculate the forces on the bodies A and B in terms of forces on the field. Let us first calculate the forces on an element of a tube of magnetic flux as shown in Fig. 2 (a). The flux density at any point of the tube is given as B and the magnetic field strength as H, where $B=\mu_0 H$. To find the force on the element of tube, we surround the element by a membrane (shown by the dotted line in Fig. 2 (a)). The force on the element of tube can then be calculated as the force that would act on the membrane if the element were removed.

The way to remove this flux is to place at the membrane a suitable distribution of current and magnetic pole strength, which will cancel the field inside the element of tube. At the ends of the tube we need to put a surface distribution of pole strength σ, such that $\sigma=B$ where the positive direction of B is away from the element under consideration. On the curved surface of the tube we need to place a surface distribution of current of density J, such that $J=H$ at the surface of the tube. The direction of the current J must be such as to cancel the field inside the tube. This system is shown in Fig. 2 (b).

The forces on the membrane can now be computed.

At the ends there will be a tension of strength $\frac{1}{2}\sigma H$ per unit area, and at the curved surface there will be a pressure of strength $\frac{1}{2}$ BJ. The factor $\frac{1}{2}$ arises from the fact that we have to consider the average field. Outside the membrane, this field is B and H, inside it is zero. Since $\sigma = B$ and $J = H$, we can say that along the tube of flux there is a tension of $\frac{1}{2}$ BH and perpendicular to the tube of flux there is a pressure of $\frac{1}{2}$ BH. The derivation of this result fits into our mental picture of forces on currents and poles. We are not committed to any particular view which treats the field as more "real" than an electric current.

It follows by inspection that in an electric field there will be a tension of $\frac{1}{2}$ DE along the tubes of force and also a transverse pressure of $\frac{1}{2}$ DE. To derive this result we should have to terminate a tube of electric force by a charge distribution at the ends and a distribution of "magnetic current" over the curved surface. Such a magnetic current should be regarded as a device for ease of calculation in the same way as magnetic poles are such a device.

By choosing a tube of flux, we have chosen the principal stresses in the field. The stresses at any arbitrary angle θ to a tube of flux can easily be derived. Let them be denoted by a normal stress f_n and a shear stress f_t. Consider the equilibrium of a wedge of unit depth into the paper as shown in Fig. 3.

$$-f_n = \tfrac{1}{2}\,BH\cos^2\theta - \tfrac{1}{2}\,BH\sin^2\theta$$

$$-f_t = BH\sin\theta\cos\theta$$

Now $(B\cos\theta)$ and $(H\cos\theta)$ can be written as B_t and H_t, respectively, and $(B\sin\theta)$ and $(H\sin\theta)$ can be written as B_n and H_n, respectively, therefore

$$f_n = \tfrac{1}{2}\,(B_nH_n - B_tH_t) = \tfrac{1}{2}\,\mu_o(H_n^2 - H_t^2)$$

$$f_t = \tfrac{1}{2}\,(B_tH_n + B_nH_t) = \mu_oH_nT_t$$

Similarly in an electrostatic field the stress is given by

$$f_n = \tfrac{1}{2}\,\epsilon_o(E_n^2 - E_t^2)$$

$$f_t = \epsilon_oE_nE_t$$

However, nothing is gained by remembering these more complicated expressions. It is more convenient to place the correct currents and charges on the surface considered and to work out the force upon these surface distributions.

To find the force on a body it is necessary to integrate the field stresses over a closed surface which completely envelops the body. This can be seen by reference to Fig. 1. Each tube of flux is associated with an element of charge. The total force therefore depends on adding the effect of all tubes of flux. That is why it is necessary to integrate the stress over a closed surface.

The actual position of this closed surface is arbitrary. If all tubes of flux are crossed at right-angles, the value of E_t at the surface will be zero, and hence the shear stress f_t will be zero. For other surfaces there will be both direct and shear stress. Every surface will be associated with its own stress distribution. Since the surface is arbitrary so also is the stress distribution. The only way to examine the stress on the body is to choose a surface which lies just outside the body and follows its shape. This is generally inconvenient. If only the total force is required, it is better to choose a surface which will make the calculation easy. These points are brought out in considering the examples given later in this article.

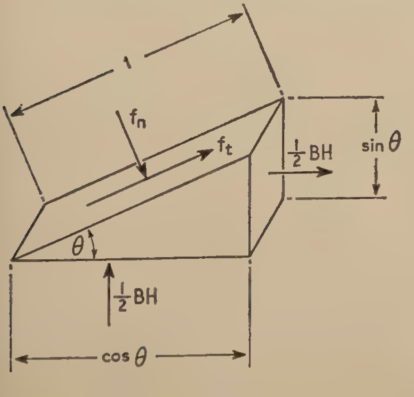


Fig. 3.—Forces on a wedge

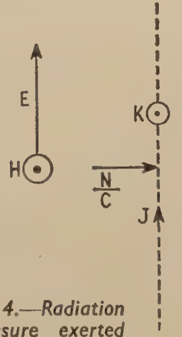


Fig. 4.—Radiation pressure exerted by a plane electromagnetic wave on a surface

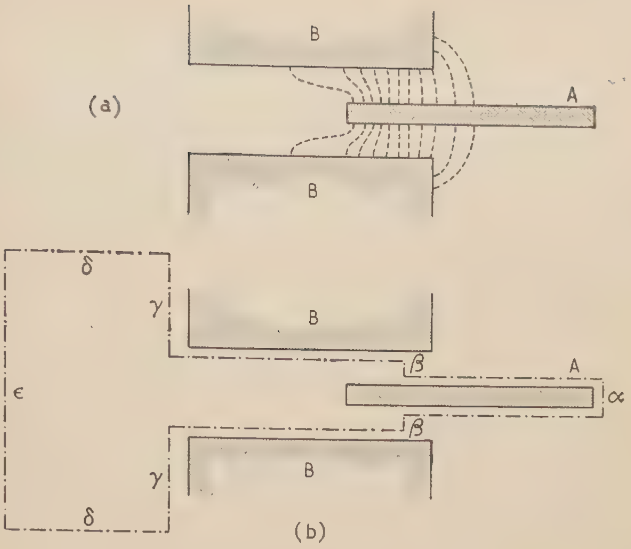
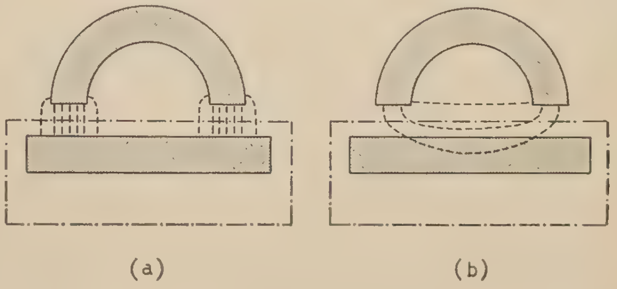


Fig. 5.—Electrostatic voltmeter

(a) the electrostatic field between the moving vane A and the fixed vane B
(b) the closed surface (dotted) used in calculating the stresses



(a) (b)

Fig. 6.—Horseshoe magnet
(a) with a magnetic bar; (b) with a non-magnetic bar

Before leaving this general discussion of stresses it is worth while to point out that the phenomenon of "radiation pressure" in electromagnetic fields can be treated in a similar manner. Consider the radiation pressure exerted by a plane electromagnetic wave on a surface, Fig. 4. To find this pressure we must place at the surface such electric and magnetic currents as will reduce the field to zero on the far side of the surface. The electric current density must be $J = H$ and the magnetic current $K = E$. The pressure is $\frac{1}{2}\,BJ + \frac{1}{2}\,DK$.

$$f_n = \tfrac{1}{2}\,(\mu_oH^2 + \epsilon_oE^2)$$

In a plane wave $E = \sqrt{\dfrac{\mu_o}{\epsilon_o}}\,H$

Hence $f_n = \sqrt{\mu_0\epsilon_0}EH = \frac{N}{c}$, where N is the Poynting vector and c the velocity of light.

We have thus arrived very simply at a result which is generally only given in advanced books and which is often taken to imply that " field theory " is intrinsically superior to " action at a distance." Our derivation shows that we are not necessarily committed to either of these theories. As always, it is a matter of convenience which we use.

Examples

(a) A simple electrostatic voltmeter.

Fig. 5 (a) shows a diagram of a simple electrostatic voltmeter. A moving vane, A, is attracted into the air gap of a fixed vane, B. A is connected to the negative voltage terminal and B to the positive terminal. The electrostatic field is roughly mapped in the figure and it is required to find the force pulling the moving vane into the air gap. The usual method of solution finds the energy stored in the system. The force is then calculated by considering a virtual displacement. We wish to use the method of stresses in the field. These stresses will have to be integrated over any closed surface which completely envelops the moving vane (or the fixed vane). Consider the surface shown dotted in Fig. 5 (b).

The field on the surface of A and B is perpendicular to the surface, since A and B are conductors. Hence, the only parts of the dotted surface that can contribute to a lateral force are the parts marked by Greek letters. If α, γ, δ and ϵ are outside the field, only β can give a lateral force. If β is chosen at a place where the field is uniform and equal to E, then the total force is $\frac{1}{2}\epsilon_0 E^2 \times$ are of β. This very quick solution should be compared with the solution in terms of energy. It should be noted that a solution can also be obtained if there is appreciable field at α and γ or if the field at β is not uniform. The energy method of solution again compares very unfavourably.

(b) A horseshoe magnet.

Fig. 6 (a) shows a horseshoe magnet lifting a piece of iron. A suitable surface of integration is shown. The usual result of an attractive force of $\frac{1}{2}\mu_0 H^2$/unit area of air gap can be seen by inspection, if a uniform field in the air gaps is assumed. It should be noted that the method of calculation makes no assumptions about the relationship of B and H in the iron. A method of solution employing a virtual displacement raises all sorts of problems about the behaviour of the iron under such a displacement.

Students often find it difficult how to explain that a non-magnetic body experiences no force, although there is still a magnetic field in the gap. One way of explaining this difficulty is by reference to Fig. 6 (b). It is clear that the dotted surface would experience an upward force in the region of the air gaps and a downward force between the ends of the magnet. This downward pressure is the usual sideways pressure associated with tubes of flux.

(c) A current in an iron tube.

Fig. 7 (a) shows a cylindrical iron tube with a current flowing through the centre. There is a transverse magnetic field of uniform flux density B outside the tube. It is required to find the total force acting on the current and the tube. The surface of integration is shown dotted.

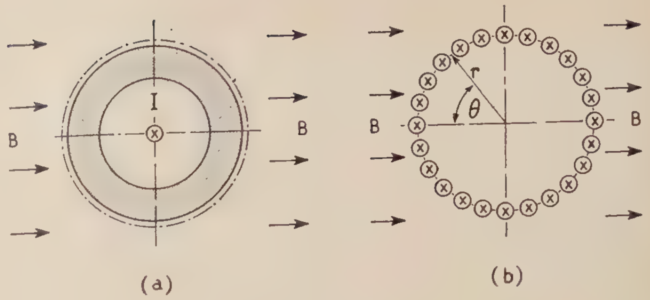


Fig. 7.—Current inside a cylindrical iron tube
(a) *surface of integration shown dotted*
(b) *disposition of current to remove the effect of the field of the original current*

To remove the effect of the field B, we shall need some suitable combination of current and pole strength. Such a combination is easily found, but we do not need to know it, since it can produce no net force in a uniform field. To remove the field of the current, we need to place at the surface a current of line density $\frac{I}{2\pi r}$, where r is the radius of the surface, Fig. 7 (b). The force on the surface will arise from the interaction of B and the surface current. The total force will be a downward force

$$F = \int_0^{2\pi} B\frac{I}{2\pi r}r\,d\theta = BI \text{ per unit length of tube.}$$

This is a very important result and is especially helpful in teaching the principles of electrical machines. It can be readily shown that the force on the current in the hole will be of the order of $\frac{B}{\mu}I$, because the current is screened by the tube. We have now shown that, regardless of the permeability of the tube, the total force on current and tube is always the same as if the tube did not exist. A realisation of this helps the student to understand how it comes about that the torque on a slotted armature does not depend on the shape of the slots and is the same as if the conductors lay in the full air gap field.

It should also be noted that in the solution of such a problem it is easier to consider the necessary surface layers rather than to integrate the pressures and tensile stresses directly. This is an important point.

(d) The centring force on two iron blocks in a magnetic field.

Fig. 8 (a) illustrates the system. It is required to find the transverse force F. A suitable surface of integration is shown in Fig. 8 (b). By inspection it can be seen that the only contribution to F is made by that part of the surface labelled α. If the field is uniform in this region, we have

$$F = \frac{1}{2}\mu_0 H^2 g \text{ per unit length of block.}$$

It should be noted that the dotted surface has to cut through the block.

To determine the force on part of the block it is necessary to separate this part from the rest of the material. Great care has to be taken with this part of the surface, because an arbitrary cut will disturb the magnetic field in its vicinity. Only two types of intersection do not cause such a disturbance. One is an intersection along the direction of the magnetisation of the iron, the other is transverse to this direction. If the direction of magnetisation is known the method is com-

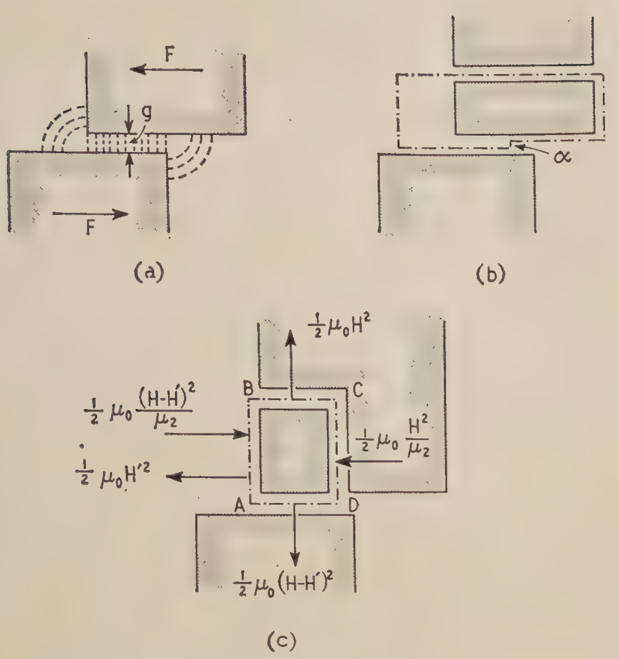


Fig. 8.—Centring force on two iron blocks in a magnetic field
(a) the magnetic field
(b) the surface of integration, dotted
(c) alternative surface of integration

pletely general and can deal with saturation, leakage flux and hysteresis. On the other hand, the application of the energy method to such complicated cases is often exceedingly difficult.

Although Fig. 8 (b) shows the force to arise in the air gap, this is clearly only a device for calculation. Intuition suggests that the force acts on the sides of the iron blocks and this impression is reinforced by looking at the field distribution of Fig. 8 (a). The question naturally arises whether we cannot investigate this idea by choosing a surface such as is shown in Fig. 8 (c).

Let H be the magnetic field in the part of the air gap where the field is uniform. Then the field in the cut CD will be $\frac{H}{\mu}$ and ABCD will experience a pressure of $\frac{1}{2}\mu_o H^2/\mu^2$. Over the region BC there will be a tensile stress of $\frac{1}{2}\mu_o H^2$. Let the leakage flux on the side AB be denoted by ϕ' and let the magnetic field strength associated with it in air be H′. In the region AD, the field strength will then be typified by $H-H'$ and there will be a tensile stress of $\frac{1}{2}\mu_o(H-H')^2$. On the side AB there will be a pressure of $\frac{1}{2}\mu_o\frac{(H-H')^2}{\mu^2}$ and a tensile stress of $\frac{1}{2}\mu_o H'^2$.

Suppose $\mu=1{,}000$ and $H'=\frac{H}{10}$, then the terms in $\frac{1}{\mu^2}$ are negligible and the sideways pull occurs in the place where we expected, namely, on the side of the block in the region where there is "leakage" flux.

This discussion has been qualitative only, but quantitative solutions could be readily obtained by numerical methods. Such solutions can give considerable help to the designer who has to ensure that the mechanical strength of a device is adequate.

Conclusion

The method of determining forces occurring in electromagnetic devices which makes use of the idea of field stresses is powerful both in calculation and in forming a clear picture of fundamental electromagnetic processes.

The objection that the concept of a field stress is unfamiliar can be overcome by deriving the field stresses in the manner shown in this article. It is then realised that the concept does not involve the view that such stresses actually occur in empty space.

Acknowledgment

This article is based on an article which was first published in the Bulletin of Electrical Engineering Education, No. 25, December, 1960, and is printed with the kind permission of the editor of the Bulletin.

AIRCRAFT EQUIPMENT AND RADIO INTERFERENCE

INFORMATION on good practice in the abatement and measurement of radio interference from electrical installations in civil aircraft is available in a new British Standard Code of Practice, CP 1012. This was prepared at the request of the Institution of Electrical Engineers' Committee on Radio Equipment for Civil Aircraft, who have the responsibility of preparing British Civil Airworthiness Requirements on behalf of the Air Registration Board, and takes account of work done by that Committee in recent years towards providing limits of radio-frequency noise at aircraft radio receiver aerial terminals.

An important feature of the Code is a recommended new technique whereby interference is measured at the receiver end of aerial feeder terminals; appropriate limits are also recommended. It is hoped that this technique will become an established means of supplementing existing requirements of the B.C.A.R. as to limits of r.f. noise at the supply terminals of electrical apparatus, and thus help towards the achievement of a consistent standard of performance from aircraft radio systems.

This Code will prove useful to those concerned with the design, construction, installation and maintenance of electrical and radio equipment for aircraft, or with the design, construction, certification and operation of aircraft. The causes of radio interference and the general principles of suppression are fully dealt with and the Code contains recommendations on the most effective methods of reducing interference to give the best practicable level of protection to radio services over the frequency ranges, between 50 kc/s and 500 Mc/s, used for radio navigational aids and communications. Guidance is given on such matters as the layout of cables, the choice and position of suppressors, and bonding and screening. Included in the appendices are an example test programme for the measurement of radio interference during flight and notes for adapting existing specifications so as to provide for capacitors intended for use as suppressors in aircraft.

Copies of the Code may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 10s each.

WIRING REGULATIONS—Revision and Amendments

Comments Invited by the I.E.E.

THE Council of the Institution of Electrical Engineers has authorised the Wiring Regulations Committee to proceed with the preparation of a 14th Edition of the Regulations. It is now almost 80 years since the "Rules and Regulations for the Prevention of Fire Risks Arising from Electric Lighting," as they were then called, were first issued. The committee which drafted them was broadly based but did not contain direct nominees of interested bodies. For the 5th Edition (1907), the Council appointed the Wiring Rules Committee, a Standing Committee, when it included representatives of the Municipal Electrical Association and some of the principal Fire Offices. The Cable Makers' Association and the Engineering Standards Committee also co-operated in the preparation of the 5th Edition.

Since that time the membership of the Wiring Regulations Committee has been extended to provide balanced representation of all the organisations directly concerned with the use of the Regulations. The present Committee includes, besides the chairman, 12 members appointed directly by the Council and 32 members nominated by interested organisations. Since 1907, also, arrangements have existed for the Wiring Regulations Committee to consider suggestions for amendment of the Regulations, not only by the organisations directly represented on the Committee but also by individuals needing the Regulations for their work, or by others such as overseas organisations who have adopted the Regulations for use in their countries.

Accordingly, an invitation is now extended to all users of the Regulations to submit their comments on, or proposed amendments to, the present (13th) Edition. Comments should be addressed to the secretary of the Institution of Electrical Engineers, Savoy Place, London, W.C.2, so as to arrive not later than 1st January, 1962, and should relate only to the 13th Edition as modified by the 1958 and 1961 Amendments.

Matters referred to in the abstracts of interpretations of the 13th Edition which have been issued from time to time will be reviewed in the course of the work for the 14th Edition, and there is no need to draw further attention to these; nor need past inquirers who have been informed that their comments will be further considered for the 14th Edition, write again.

For the 13th Edition, issued in September, 1955, the Regulations were completely reviewed and recast. Amendments were issued in December, 1958, to take account of changes in British Standards and in statutory regulations referred to in the 13th Edition, in particular by the issue of B.S. 3052, "Electric Shaver Supply Units," the preparation of which was requested by the Wiring Regulations Committee. The 1958 Amendments also incorporated a revised Regulation 507 and Note—"Test of Effectiveness of Earthing"—to take account of experience gained in the technique of earth-loop testing. The Council of the Institution have now authorised the issue of further amendments to take effect from 1st November, 1961, mainly relating to cables.

Other matters arising from developments in standardisation and practice since the issue of the 13th Edition are under consideration by the Wiring Regulations Committee. The issue of further substantial amendments would be cumbersome and inconvenient, particularly since the sections on cables are likely to be further affected, and the preparation of a new edition has therefore been agreed. The existing edition remains in force until the promulgation of the new edition. Although the time necessary for the preparation of the new edition is difficult to forecast exactly, it will not be promulgated before 31st December, 1962.

Amendments to 13th Edition

In 1961, several new British Standards for cables were published. Primarily to take account of these, and other changes in British Standards since the Regulations were last amended in December, 1958, the latest amendments, which took effect from 1st November, 1961, have been authorised. The major part of these is concerned with provisions for the use of armoured p.v.c.-insulated cables to B.S. 3346 : 1961. A notable feature of that Standard is the recognition of aluminium conductors to B.S. 2791 : 1956 as an alternative to copper conductors, and the amendments accordingly introduce into the Regulations requirements for the installation of aluminium conductors; the use of aluminium conductors of cross-sectional area of 0·0225 sq in (7/·064in) or less is not recognised, however, for the purposes of the Regulations. The amendments include tables of current rating for armoured p.v.c.-insulated cables having either copper or aluminium conductors, and installed in air, underground ducts, or direct in the ground.

A revision of B.S. 2004, "P.v.c.-Insulated Cables and Flexible Cords for Electric Power and Lighting (Non-Armoured)" was published in 1961, and the amendments take account of this, again providing for the use of aluminium conductors as an alternative to copper.

A series of three new Standards for heat-resisting types of cables and flexible cords was completed this year, together replacing the existing B.S. 1327 : 1946, "Rubber-Insulated Asbestos-Roved Flexible Cords," which is now to be withdrawn. The new Standards deal with cables and flexible cords insulated with silicone-rubber, butyl-rubber with heat-resisting fibre layer, and varnished cambric and heat-resisting fibre, and the amendments include appropriate requirements for the choice and installation of these.

In September, 1960, progress was made towards the adoption of an international colour code for the cores of flexible cords when, at the 44th plenary meeting of the International Commission on Rules for the Approval of

Electrical Equipment (the C.E.E.), held in London, there was unanimous agreement that the earthing core in flexible cables and flexible cords should be identified by a combination of the colours green and yellow. All the member countries of the C.E.E. (i.e. 15 European countries, including the United Kingdom), agreed to recognise this method of identification either as an alternative to their existing colour code or as their sole national standard. The amendments now recognise the use of the C.E.E. method as an alternative to the use of the existing national standard colour, i.e. green. It has not proved possible for the C.E.E. to reach full agreement upon the method of identification of the other cores in flexible cables and flexible cords, and the colours red and black continue to be the only ones recognised in Regulations for identifying the live and neutral cores. As a further aid to European standardisation, a new definition of the term "extra-low voltage" has been introduced in the amendments which is substantially in accord with the definition adopted in the C.E.E. member countries.

The Regulations with 1961 Amendments have been approved by the Minister of Power and the Secretary of State for Scotland for the purpose of the Electricity Supply Regulations, 1937.

Copies of the 1961 Amendments may be obtained from the secretary of the Institution of Electrical Engineers, 2, Savoy Place, W.C.2, price 2s 6d, post free; these need to be read in conjunction with the text of the 13th Edition (1955) with the 1958 Amendments. A further printing of the 13th Edition incorporating the 1958 and 1961 Amendments has been put in hand, and copies of this will shortly be available from the Institution, price 6s 6d, post free.

I.E.E. DIVISIONAL PLAN APPROVED

MEMBERS of the Institution of Electrical Engineers last week voted in support of the Council's plan for replacing the present specialised Sections by a divisional structure, designed to improve the Institution's handling of its activities as a learned society.

At a special general meeting of corporate members on 2nd November, bye-law changes, which the introduction of the new structure will necessitate, were proposed. On a show of hands, these were approved by the majority of the 284 members present, only five voting against.

Little comment on the proposed bye-law changes was offered at the meeting. One member asked the meeting to consider carefully the possible effects of dividing the Institution's activities too firmly into "electronics" and "power"; to this, Mr. A. H. Mumford (vice-president, and chairman of the panel responsible for evolving the divisional scheme) replied that the intention was to recognise the interdependence of these two branches of the science by a sufficiently flexible structure and a "central" division which would deal with subjects of common interest.

Another member queried the method proposed for registration of members in the electronics and power divisions but, because this did not form part of the matter before the meeting—that is, the amendment of the bye-laws so as to permit the setting up of a divisional structure—he was ruled out of order by the President.

There was virtually no other contribution to the discussion.

Approval by the Privy Council is needed before the necessary changes can be written into the bye-laws, but the Council are losing no time in preparing for the introduction of the new scheme in October, 1962, by which time it is hoped that the authority of the Privy Council to proceed will have been received.

Under the scheme, the present four specialised Sections will be replaced by three divisions: Electronics; Power; and Science and General, and each division will work through about ten relatively specialised professional groups. These thirty groups will together cover the whole range of electrical engineering and their number and coverage can be modified quickly to reflect any change of emphasis in the technological scene. New researches and developments, in particular, can be followed up without delay by the formation of corresponding new professional groups.

The Institution states that it is intended that the method of registration of members in the Electronics and Power Divisions will be exactly similar to that applying for many years past to membership of the specialised Sections but, in the case of the Science and General Division, nothing more than a request for registration will be required.

Atlas Lighting Manual

THE latest edition of the Illuminating Engineering Society's Code calls for higher illumination levels and more exacting attention to quality in lighting. During recent years lighting equipment has become more diverse and lighting techniques more complicated. In this country, therefore, there is a need for a publication which bridges the gap between theoretical considerations and the practical design of good lighting installations. Recognising this, Atlas Lighting, Ltd., have produced a comprehensive 400-page lighting manual. The manual has been written by a team of specialists, well known for their work in illuminating engineering, and has been edited by Mr. H. Hewitt, deputy manager of the Atlas Lighting Laboratories, and Mr. H. C. Weston, who was recently awarded the I.E.S. Gold Medal for his contributions to lighting development.

The manual begins with a study of visual processes and visual needs. A review of the principles underlying the production of artificial light and the nature of light sources is followed by a practical and comprehensive treatment of the way in which light is utilised to afford the standards of visibility and comfort consistent with modern living and working conditions. The manual contains all the information and data necessary to design a lighting installation and an extensive appendix giving detailed performance data for Atlas lamps and lighting equipment. Bound in a sturdy loose-leaf binder to facilitate the inclusion of subsequent amendments, the manual is available from Atlas Lighting, Ltd., Thorn House, Upper St. Martin's Lane, London, W.C.2, price 25s.

Short-Circuit Ratings of Aluminium Cables

By A. G. THOMAS, B.Sc., A.M.I.E.E., A.M.Amer.I.E.E.*

A great deal of work has been carried out by the Electrical Research Association and others in connection with the short-circuit ratings of paper-insulated lead-sheathed cables. This article predicts the behaviour of aluminium cables in this respect, based on the known properties of the metal

THE development work on short-circuit ratings that has been carried out recently by Gosland and Parr[1,2] has provided new data to supersede the old limits suggested by Melsom[3] in 1937, and this represents a valuable contribution in these days of ever-increasing loading demands. So far the development work has been confined to conventional paper-insulated lead-sheathed cables, although results of further tests on other cables may be expected in the not-too-distant future. In the meantime, however, it may be of some value to predict the probable behaviour of aluminium with respect to the limiting factors described by Gosland and Parr, estimating these predictions from known properties of the metal.

Limiting Factors

The temperature of the conductor, whether of copper or aluminium, may rise to as much as 270°C without doing permanent damage to the insulation.[4,5,6] For other reasons, however, this temperature is never actually permitted. The heating of copper cables compared with aluminium cables is shown in Fig. 1.

A well-made soldered joint normally has a lower resistance than a corresponding length of plain conductor and should therefore run cooler. Also of significance, where short-term heating effects are concerned, is the greater thermal capacity of the joint, which may thereby possess a substantial margin of safety. Beavis[7] considers that the maximum temperature of a soldered joint may be about 20°C below that of the plain conductor, and Gosland and Parr have recorded temperature values on soldered joints ranging from 37 to 82 per cent of the conductor temperature. Tin/lead solders begin to soften at 183°C, and a soldered joint is certainly safe at 160°C—the temperature limit imposed by considerations of longitudinal expansion.

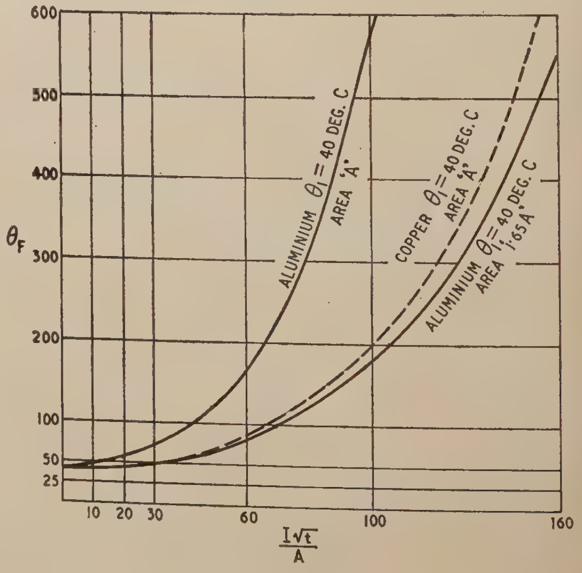
Although a few aluminium solders have a low melting point, with many it is slightly higher than tin/lead solder, and there is thus a satisfactory margin of safety with these also.

Temperature Rise of the Sheath

The limiting temperature for a lead sheath has been found to be 250°C, and the use of aluminium conductors would not influence this limit. With aluminium sheathing, however, it seems unlikely that the possibility of fracture will arise even at this temperature, although, of course, some types of anti-corrosion serving may impose a lower limit. Undoubtedly the strong aluminium sheath will exert considerable expansion forces if it is heated rapidly by this amount. If its expansion is restrained damage to the cable supports or the terminations may be a more onerous limit, but the value of 250°C seems to be a reasonable basis for calculating the short-circuit current that an aluminium sheath can carry.

In fact, the current-carrying capacity is so large (3·5 times that for lead in the case of a sheath to B.S.480 : 1954, Part 2, and about 1·75 times for thin corrugated sheaths) that only rarely will such a temperature be reached in practical installations. Usually the conductor current is a more onerous limit. A possible case where it can happen is on single-core 11 kV cables between transformers and switchgear under earth fault conditions. Table I shows the limit imposed by the lead sheath of such cables and the extent to which it can be raised by using either a corrugated or a plain aluminium sheath, see also Fig. 2.

Fig. 1.—Heating effect of copper cable compared with an aluminium cable of equal cross-section and an aluminium cable of equal resistance



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* Alcan Industries, Ltd.

TABLE I.—THE SUCCESSIVE LIMITS IMPOSED BY EITHER SHEATH OR CONDUCTOR ON 11 kV SINGLE-CORE CABLE. IMPROVEMENTS IN PERFORMANCE ARE MADE EITHER BY SELECTING A LARGER CABLE (MOVING DOWNWARDS), OR BY CHANGING MATERIALS (MOVING TO THE RIGHT)

Size of single core cable 11 kV sq in	1st Limit		2nd Limit		3rd Limit		4th Limit		5th Limit	
0·0225	Al Cond.	1·2 kA	Pb Sh. Cu Cond.	1·8 kA 1·8 kA	—		—		—	
0·04	Al Cond. Pb Sh.	1·9 kA	Cu Cond.	3·0 kA	—		—		—	
0·06	Pb Sh.	2·0 kA	Al Cond.	3·1 kA	Al ½ Sh.	3·5 kA	Cu Cond.	4·8 kA		
0·10	Pb Sh.	2·4 kA	Al ½ Sh.	4·2 kA	Al Cond.	5·2 kA	Cu Cond.	8·0 kA		
0·15	Pb Sh.	3·1 kA	Al ½ Sh.	5·4 kA	Al Cond.	7·1 kA	Al Sh.	10·8 kA	Cu Cond.	11 kA
0·20	Pb Sh	3·4 kA	Al ½ Sh.	6·0 kA	Al Cond.	11·0 kA	Al Sh.	12·0 kA	Cu Cond.	17 kA
0·25	Pb Sh.	3·8 kA	Al ½ Sh.	6·7 kA	Al Cond.	13·0 kA	Al Sh.	13·3 kA	Cu Cond.	20 kA
0·30	Pb Sh.	4·7 kA	Al ½ Sh.	8·2 kA	Al Cond.	15·0 kA	Al Sh.	16·4 kA	Cu Cond.	23 kA
0·40	Pb Sh.	5·1 kA	Al ½ Sh.	8·9 kA	Al Sh.	17·8 kA	Al Cond.	19·5 kA	Cu Cond.	30 kA

ORDER OF MERIT: *SHEATH*: Lead, Corrugated Aluminium, Plain Aluminium, Plain Aluminium plus Aluminium Armour.
CONDUCTOR: Aluminium, Copper.

BASIS: *CONDUCTOR.* Fig. 1 of Mr. G. S. Buckingham's paper[8] amended for aluminium.
SHEATH. Fig. 4 of Mr. G. S. Buckingham's paper[8] amended for aluminium.

Plain aluminium sheath of same cross-sectional area as lead. Both to B.S. 480 : 1954.
Corrugated aluminium sheath of half cross-sectional area of lead.
Currents are values for 1 second.

Since it was found that charring of outer cable papers would occur only if the sheath temperature were allowed to exceed the 250°C limit by some considerable margin, i.e. perhaps 20°C or so, this is not regarded as a likely source of danger. Gosland and Parr found that with lead-sheathed steel-armoured cables the armour temperature was always less than that of the sheath, and it is likely that with an aluminium-sheathed steel-armoured cable—if such were used—the armour would run even cooler. With a lead-sheathed aluminium-armoured cable, however, the current distribution would be such that the aluminium armour wire would run appreciably hotter than the sheath. Experimental work may show that heat losses from the armour are significant, in which case it seems likely that the temperature of the armour could be permitted to rise to a higher value, provided, of course, that the sheath temperature did not exceed the 250°C limit. Until such experimental evidence is available, however, it would be reasonable to assume that the temperature of the armour can rise only as high as the sheath limit.

The amount of short-circuit current that aluminium wire armour can carry must be calculated for each cable according to the wire sizes. It may be practicable to make an allowance for the current-carrying capacity of the lead sheath, but in all probability this would be so small as to be negligible. If the total cross-sectional area of the wire armour exceeds 75 per cent that of the largest aluminium core conductor—or 115 per cent in the case of copper conductors—then the armour temperature will not exceed 250°C on carrying any earth fault current carried by the core. These figures are based on the pessimistic assumption that the armour temperature at full load is only 5°C lower than that of the conductor, although in soil of low resistivity conditions would be much more favourable to the armour.

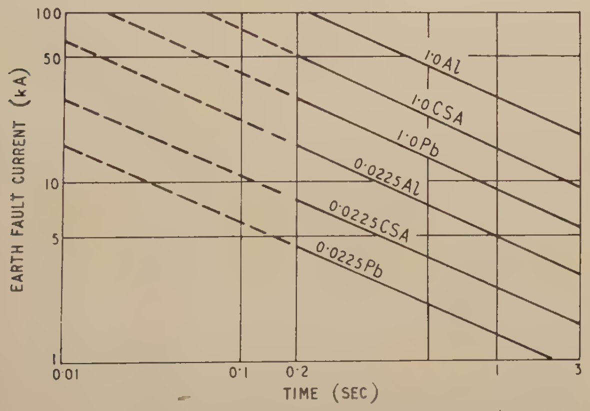

Fig. 2.—Safe sheath currents in two sizes of 11 kV single-core cables with lead sheath, corrugated aluminium sheath, or plain aluminium sheath, based on a maximum sheath temperature of 250°C

Should a cable with aluminium armour or sheath be installed in parallel with other types of cable there is a danger that a large share of the total earth fault current will flow through the aluminium. The current the aluminium armour carries may be provided not only by its cores but by those of other cables as well, and under these conditions damage is possible. It must be appreciated, however, that where steel armour might survive in such circumstances it would be at the cost of a higher voltage on the equipment subject to fault.

Conductivity of Armour Bonds

The practice of using aluminium armour wires in conjunction with lead sheathing has been adopted for a number of applications, such as on submarine cables, resulting in excellent long-term durability. Where magnetic steel wires or tapes are not permissible aluminium is the preferred material for armouring, and if such armour wires are carefully bonded they will effectively assist the lead sheath in the carrying of earth fault currents. Certain shortcomings have been reported in connection with the normal armour bond on steel wires, however, and these shortcomings are very likely to be magnified if the same clips are used with aluminium wires, since the latter can carry so much more current. Experimental results obtained with normal currents suggest that a well-designed type of gland should be able to perform this duty with greater efficiency. For straight-through joints it is suggested that the armour wires be bent back rather than cut, and that they are reinstated after the sheath has been plumbed. Either soldering or compression techniques may be used for the jointing of the armour wires.

Resistance to Electromagnetic Forces

If short-circuit ratings were determined by a limiting value of conductor temperature only, short-duration faults of very high current would be permissible. However, a situation may arise where a fault is within the limits set

TABLE II.—CHARACTERISTICS OF MATERIALS

	Electrical Purity Aluminium(1) (BS2627 GIE¾H)	Aluminium(2) (Noral D50SWP)	Copper (Annealed)	Lead	Steel (BS1442)
Coefficient of Thermal Expansion (10^{-6} per 1°C)	23	23	17		12
Modulus of Elasticity (10^6 lb/sq in)	10	10	17		30
Specific Heat (s)	0·21	0·21	0·092	0·031	0·12
Typical Resistivity at 20°C (microhms/cm³) (e)	2·8	3·2	1·7	21	13
Temperature coefficient of resistance at 20°C, per 1°C (α)	0·00403	0·0036	0·00393	0·004	0·0045
Density lb/cu in (d)	0·098	0·098	0·318	0·41	0·285
K $\left(= 69{\cdot}4\sqrt{\frac{ds}{\alpha e}}\right)$	94	92	146(3)	27(3)	53(3)

1. This material can be used for conductors, sheaths and armour wires.
2. A stronger alternative material for wire armour.
3. Values from F/T195.

by considerations of conductor temperature, but which may, nevertheless, give rise to an electromagnetic force of sufficient amplitude to burst the cable. Currents required to burst conventional paper-insulated lead-sheathed cables are high, but modern conditions of increasing fault levels are such that the danger of bursting has to be considered. If a cable does burst, the danger is not confined to the destruction of the cable; consequential damage and fire may also be possible. Gosland and Parr give formulæ for calculating the bursting strength of paper-insulated lead-sheathed cables, and these involve the thickness and tensile properties of the belt papers and sheath. These formulæ have been verified by experiment, and calculated values employing them have been presented by Buckingham.[8]

The formulæ do not involve properties of the conductor material, and they are therefore equally applicable to aluminium-cored cable. However, where an aluminium sheath is used it will be found that by substituting the ultimate tensile strength of aluminium in the formulæ the bursting strength is raised well beyond realistic requirements.

One specific test carried out by the Electrical Research Association under the sponsorship of the aluminium industry gives good proof of the strength of aluminium sheathing. A three-core Continental cable of 120 sq mm (about 0·19 sq in) in aluminium, equivalent to a British 1·1 kV cable, was subjected to 46,000 A r.m.s. for 0·2 sec. This current value is almost double that recommended for a lead-sheathed cable, and the heating function, I^2t, is 1·4 times that for a 0·2 sq in copper cable. The heating was sufficient to char the papers and render the cable unservicable, but there was no bursting or consequential damage.

TABLE III.—VALUES OF SHORT-CIRCUIT CURRENT RATINGS FOR 11 kV THREE-CORE BELTED CABLES

Size sq in	Limit imposed by bursting. Copper or Aluminium Conductors Amperes	Limit imposed by heating (65-160°C). Symmetrical r.m.s. amperes for 1 sec: Aluminium Conductor Amperes	Copper Conductor Amperes	Critical Time Briefer faults may damage cable by bursting rather than by buckling of joints: Aluminium Conductor Seconds	Copper Conductor Seconds
0·0225	—	1,120	1,730	—	—
0·04	28,000	2,000	3,080	0·005	0·012
0·06	31,000	3,000	4,600	0·009	0·022
0·10	33,000	5,000	7,700	0·023	0·055
0·15	34,000	7,500	11,600	0·049	0·12
0·20	37,000	10,000	15,400	0·073	0·17
0·25	39,000	12,500	19,300	0·10	0·25
0·30	40,000	15,000	23,100	0·14	0·33
0·40	42,000	20,000	30,800	0·23	0·51

Effects of Longitudinal Expansion

The longitudinal expansion that occurs with rise in temperature tends to make the conductor ends enter the joint boxes, and so there is a temperature beyond which a joint will be in danger of buckling. Gosland and Parr have found that this effect is usually the limiting one, demanding a maximum temperature limit of 120°C above the stress-free temperature, and so a careful comparison of the relevant physical properties of copper and aluminium is necessary.

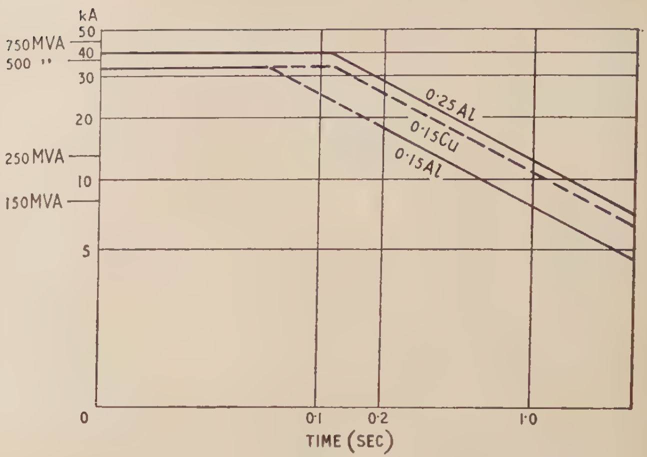

Fig. 3.—Current limit imposed on cables
(11 kV 3-core belted s.w.a. to B.S. 480 : 1954)

The coefficient of thermal expansion of aluminium is greater than that of copper and so, superficially, it would appear that under equivalent conditions aluminium would fare rather worse than copper. This is not so in fact, since the expansion of the conductors is not free but is restrained, and to determine the relative forces it is necessary to take into account the moduli of elasticity of the two metals. Fortunately the differences in elasticity are such that the higher expansion rate of aluminium is more than compensated for, and consequently, under perfectly rigid conditions where the longitudinal expansion is not relieved by lateral movement, an aluminium joint would theoretically be subjected to a somewhat lower force than a corresponding one in copper.

This force is proportional to the product of the modulus of elasticity and coefficient of expansion, and taking the relevant values from Table I the following expression gives the force generated in a length of aluminium in terms of that generated in an equivalent length of copper under the same conditions:—

$$\frac{(10 \times 10^6)\ \ (23 \times 10^{-6})}{(17 \times 10^6)\ \ (17 \times 10^{-6})} = \frac{230}{289} \simeq 0{\cdot}8$$

Thus the force upon an aluminium conductor joint would be only about 0·8 that of the force upon a similar copper conductor joint, provided, of course, that the materials were not stressed beyond their respective elastic limits.

Strictly, this analysis is only true for rigid columns, and some experimental evidence will be required to ascertain how these considerations are modified by the metals being in cable form. Some evidence is available already from work carried out at Aluminium Laboratories, Ltd., on stranded plastic-insulated aluminium and copper cables of similar current-carrying capacity and design in general. The cables for these experiments were terminated in the ordinary way, except that the terminals were modified to facilitate the precise measurement of the forces to which they were subjected. The rate of temperature rise applied was slow as compared with that in short-circuit conditions, and it was found that although the aluminium conductors were somewhat larger than the copper ones, the stresses recorded were about the same in each.

TABLE IV.—VALUES OF SHORT-CIRCUIT CURRENT RATINGS FOR 1·1 kV FOUR-CORE BELTED CABLES

Size sq in	Limit imposed by bursting. Copper or Aluminium Conductors	Limit imposed by heating (80-160°C) (Approx.). Symmetrical r.m.s. amperes for 1 sec		Critical Time Briefer faults may damage cable by bursting rather than by buckling of joints	
	Amperes	Aluminium Conductor Amperes	Copper Conductor Amperes	Aluminium Conductor Seconds	Copper Conductor Seconds
0·0225	15,000	1,030	1,580	0·005	0·011
0·04	15,500	1,830	2,820	0·014	0·033
0·06	19,000	2,740	4,210	0·021	0·050
0·10	20,000	4,590	7,050	0·052	0·12
0·15	22,000	6,900	10,600	0·10	0·23
0·20	24,000	9,150	14,100	0·15	0·34
0·25	26,000	11,500	17,700	0·20	0·46
0·30	28,000	13,700	21,100	0·24	0·57
0·40	32,000	18,300	28,200	0·33	0·78
0·50	35,000	22,800	35,000	0·42	1·0

Calculation of Temperature Rise

From the foregoing considerations it seems reasonable to suppose that there is some margin of safety in making the assumption that where the short-circuit limit for copper is expressed as a maximum temperature value, the same limit can apply also to aluminium. This value is fixed at 160°C—the temperature at which joints may be about to fail by buckling.

To calculate the current density and time required to produce such a temperature rise Gosland and Parr have presented the following formula:—

$$I\sqrt{t} = KA\sqrt{\log_e(\theta\alpha+1)}$$

Where I = r.m.s. current in kA

t = time of current flow in seconds

K = constant for conductor material derived from physical properties

A = total cross-sectional area of metal in one core in sq in

θ = temperature change caused by short circuit in °C

α = temperature coefficient of resistivity of conductor material at the temperature at the start of the short circuit.

TABLE V.—COMPARISON OF ALUMINIUM CONDUCTOR CABLES WITH COPPER CONDUCTOR CABLES OF THE SAME TYPE. FIGURES BASED UPON 1·1 kV FOUR-CORE P.I.L.C. S.W.A. AND S. CABLE IN AIR

Size of Copper Cable (sq in)	Size of Aluminium Cable (sq in)	"Bursting Current" (Al/Cu)	"Buckling Current" (Al/Cu)	Current Carrying Capacity (Al/Cu)	Conductance $\frac{R_{cu}}{R_{al}}$
0·0225	0·0225 0·04	1·00 1·03	0·65 1·16	0·78 1·09	0·61 1·09
0·04	0·04 0·06	1·00 1·23	0·65 0·97	0·78 1·00	0·61 0·92
0·06	0·06 0·10	1·00 1·05	0·65 1·08	0·78 1·09	0·61 0·98
0·10	0·10 0·15 0·20	1·00 1·10 1·20	0·65 0·97 1·30	0·78 0·98 1·20	0·61 0·89 1·19
0·15	0·15 0·20 0·25	1·00 1·09 1·18	0·65 0·87 1·08	0·78 0·95 1·10	0·61 0·81 1·02
0·20	0·25 0·30 0·40	1·08 1·17 1·33	0·81 0·97 1·30	0·90 1·04 1·25	0·76 0·94 1·26
0·25	0·30 0·40	1·08 1·23	0·78 1·04	0·90 1·09	0·75 1·01
0·30	0·40 0·50	1·14 1·25	0·87 1·09	0·95 1·05	0·83 1·05
0·40	0·50 0·60 0·75	1·09 1·25 1·31	0·81 0·97 1·21	0·87 0·98 1·11	0·75 0·91 1·12
0·50	0·60 0·75	1·14 1·20	0·78 0·98	0·90 1·02	0·74 0·92

From Table II, which gives specific values, it will be seen that while aluminium has a value of K of only about two-thirds that of copper, when considering cables of equal current-carrying capacity the value of A for aluminium will, of course, be 1·5 times that of copper. The value for KA is therefore more or less the same for aluminium and copper cables of equal current-carrying capacity. Since the differences involved in the remainder of the formula are small by comparison it can be seen that short-circuit ratings, in so far as heating effects are concerned, may also be the same in terms of $I\sqrt{t}$.

Buckingham gives graphs showing the current limit imposed on cables. The limit is in two parts, a horizontal line representing the "bursting current" and a sloping line representing the "buckling current." Fig. 3 is based on Fig. 1 of Buckingham's paper and shows the same line for a 0·15 sq in three-core 11 kV belted cable with copper conductors. The line for a cable identical in all respects except that its conductors are of aluminium is also shown; it will be seen that the "buckling current" is lower, but that the "bursting current" is the same. A more usual comparison with a 0·15 sq in copper cable is a 0·25 sq in aluminium cable. This has both "bursting currents" and "buckling currents" higher than those of the copper cable.

Aluminium cables are not made "equivalent" to copper cables, indeed there are so many different ways of comparison that this would be impracticable. Instead, aluminium cables are made in the same range of physical sizes as copper cables and the engineer should choose the aluminium cable from the properties that are tabulated in Tables III and IV, and for normal ratings from, for example, "Aluminium for Insulated Cables."[9] Ideally, he should not select a copper size and then take the equivalent aluminium size, but since this must be a common practice Table V shows the alternative sizes for aluminium cable that can be used for each size of copper cable, and expresses the relevant properties in fractions of the properties of copper. From these tables it will be seen that in many cases an aluminium conductor cable is at least equal to, and in some cases superior to, its copper counterpart in so far as short-circuit ratings are concerned.

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AXIAL FORCES IN TRANSFORMER WINDINGS

AN individual turn of a transformer winding through which current is passing may experience two kinds of force: that due directly to the magnetic field in which the turn lies and to which the current itself gives rise, and that due to the direct physical thrusts of its neighbours. When tappings are made in one or both of the concentric windings of a transformer the magnetic field may be such that the axial magnetic force exerted on the successive turns of a particular winding changes sign several times along its length. In such cases complications arise in the calculation of the total axial compressive force at a given point of the winding for it is found that, because a turn of a helical winding can push its neighbour physically but cannot pull it, the exact position of that section of the winding responsible for the physical thrust is not immediately obvious.

Analysis of the conditions under which adjacent forces may be summed algebraically shows that there are points of the winding across which summations cannot be made without careful investigation of the validity of the process and amongst these points is at least one across which summations cannot be made at all. Expressions representing the thrusts of long sections of a winding are therefore built up of a number of smaller basic thrusts, each of which involves no awkward point and is therefore obtained by straightforward integration. These basic thrusts are then added together, the conditions under which this can be done being incorporated into the formula with the aid of a simple notation. A methodical way of summing thrusts having been established, the points across which summations cannot be made are determined and all the required formulæ are greatly simplified.

This work is fully described in a recently-issued report of the Electrical Research Association entitled " A Method Based on Maxwell's Equations for Calculating the Axial Short-Circuit Forces in the Concentric Windings of an Idealised Transformer," by P. R. Vein (Ref. Q/R151). Copies, price 15s, postage 6d, may be obtained from the Association at Cleeve Road, Leatherhead, Surrey.

For a given transformer and a given arrangement of tappings the report also derives analytical expressions for the compressive forces in terms of the magnetic vector potentials in the two windings, formulæ for which have already been deduced by Rabins. The method of solution is outlined for the general case and numerical values are computed in two simple cases.

Bristol Siddeley Engines

RECENTLY we visited the Power Division of Bristol Siddeley Engines, Ltd., at Ansty, near Coventry. Apart from producing rocket engines this Division of the company manufactures Maybach diesels for marine and rail traction, gas turbines for marine propulsion and for static and transportable electricity generating sets rated up to 15 MW, and gas-bearing pumps and compressors.

One of the items of equipment which we saw during our visit was the 3 MW " power package." This consists of a complete generating plant, including a " Proteus " gas turbine with a generator and associated control equipment, all housed in a single aluminium package which can be transported by air, by road on a single semi-trailer, by rail, or it can be lowered on to any level firm site for stationary use without specially prepared foundations or buildings.

Bristol Siddeley 3 MW remote-controlled power stations have been in service for two years already in the United Kingdom with the South Western Electricity Board and such has been their success that further sets are being constructed. These generators are controlled by telephone from the Board's headquarters 100 miles away and need no permanent operating or maintenance staff.

When used for peak-lopping and similar intermittent duties, a visit every three or four months and an overhaul every ten years is all the maintenance required. As the lightweight gas turbine can be started from cold in any climate, reaching full power in two or three minutes, emergency standby costs are negligible.

The " power package " is completely self-contained, the only requirement being a fuel supply. A notable feature is the range of fuels that can be used with the industrial " Proteus "; fuel systems are available for kerosene, diesel fuel and natural gas. The air intake and exhaust systems are silenced to a level acceptable for residential areas.

ILLUMINATING ENGINEERING

THE recent publication by the Illuminating Engineering Society of its new Code and recommendations for lighting practice in this country, followed by its technical report No. 2, is now supplemented by a comprehensive 40-page technical brochure which has just been published by the Lighting and Heating Group of the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. Although the aims of the I.E.S. Code are clearly stated, and the provision for working within its new concepts are adequately set down for the lighting engineer, the G.E.C. feels that there is a need for someone to demonstrate the effects which the Code has within typical lighting schemes for commercial and industrial use; and even more important, of the effects it can have on the structure and composition of new buildings. The new brochure therefore shows in as simple a form as possible how the Code works in relation to all types of lighting planning.

THE DONCASTER DISTRICT:

Its Evolution and Development

By J. L. FERNS, B.Sc., M.I.E.E., A.M.C.T.*

In the Yorkshire Electricity Board's Doncaster District the last non-standard a.c. supplies have recently been converted to the national standard and the last d.c. consumer on the general 230/460 V supply network established 60 years ago has been changed over during the past month. In this article the author surveys development in the District since the electricity supply industry was nationalised on 1st April, 1948

THE Doncaster District of the Yorkshire Electricity Board was formed by adding portions of the ex-Yorkshire Electric Power Co. (and its subsidiaries—the E.D.Y. Co. and Electricity House, Ltd.) and the ex-North Lincolnshire and Howdenshire Co. to the ex-Doncaster and ex-Adwick undertakings. Fig. 1 shows the extent of the e.h.v. network at vesting day and the primary sources of energy feeding into that network. The diagram does not attempt to differentiate between voltages and it should be observed that the 3·3 kV portion of the network was limited to the centre of Doncaster and to the Bentley and Adwick regions. The remainder operated at 11 kV except for a tiny area in Thorne which ran at 2,000 V. As an illustration of the complexity of the electrical supplies in the District it may be mentioned that the National Coal Board gave a large supply to the railway works in the centre of Doncaster and only a matter of yards from the Doncaster power station. The N.C.B. also had general distribution networks in the two large mining villages of Edlington and Armthorpe.

The first measure of a supply undertaking's status is the amount of electricity sold. Fig. 2 shows the continuous above-average rate of growth in kWh sales. The last two increases were 13·3 and 14·1 per cent. Whilst industry has grown considerably the increases are not solely due to some outstanding factory developments. They stem from advances in all fields—commercial, domestic and agricultural, as well as industrial. Future prospects are extremely good because the N.C.B. programme of mine electrification is only just beginning to have effect in the Doncaster area and there is no lack of building development. Doncaster has fortunately a wide variety of industries—indeed there are scarcely any instances of two factories doing the same kind of trade—and this state of affairs greatly helps to avoid pronounced ups and downs in the level of employment.

The number of consumers has risen from 45,000 at vesting day to the present total of 73,000. This large increase is due to taking over two N.C.B. distribution networks (4,231 consumers) as well as to the big programmes of new house building actively pursued by the local authorities and private builders to meet the large local demand.

Fig. 3 shows the e.h.v. network at the present time. Comparison with Fig. 1 reveals the enormous amount of development for which the Board has been responsible. The e.h.v. mains have increased from 190 to 450 miles, the l.v. mains have increased from 280 to 480 miles, and the number of substations (which includes pole type transformers) has risen from 225 to 900. When the present

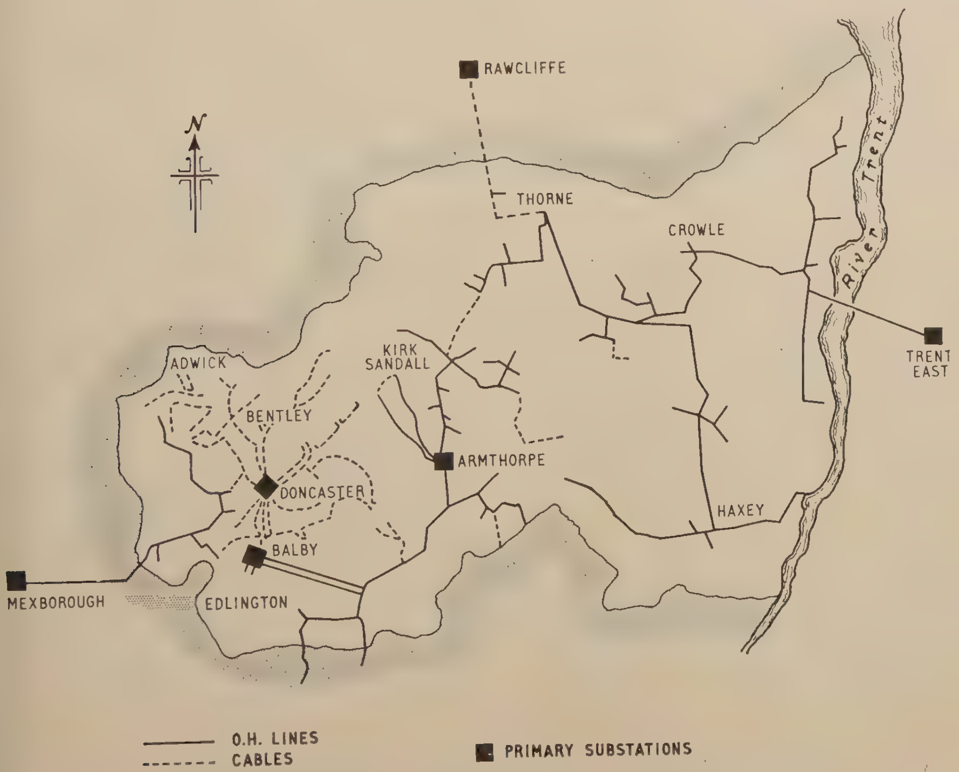

Fig. 1.—E.h.v. cables and lines in the Doncaster district in 1948

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* Manager, Doncaster District, Yorkshire Electricity Board.

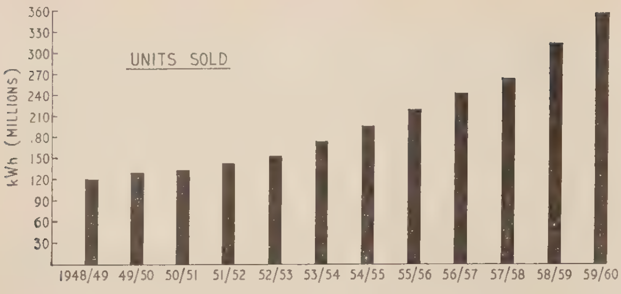


Fig. 2.—The last two increases in the steadily rising number of units sold were 13·3 and 14·1 per cent

approved schemes are completed there will be only ten farms without supply in the whole 234 square miles of the District. The ten farms referred to have been offered a supply but have chosen not to accept the Board's moderate terms for personal reasons. On vesting day ten villages and 800 farms were without supply.

Another improvement factor which is revealed by a comparison of Figs. 1 and 3 is the increase in the number of primary substations. The need in the industrialised urban region of Doncaster can no doubt be readily visualised but the two primaries which have been created in the eastern rural area at Crowle and Haxey are of great importance to consumer satisfaction. Before they were introduced the 11 kV supply had to pass through extremely long overhead lines and, consequently, the voltage drop at times of full load (and still more so at times of maintenance or lightning troubles when the alternative route had to be employed) was most troublesome.

At vesting day the District did not possess a single showroom in a shopping centre. The former undertakings utilised a portion of their offices for such appliance sales activities as took place. By the introduction of a service centre in the shopping centre of Doncaster and the creation of service centres in Adwick and Thorne, the Board was able to provide a more adequate service to its consumers. Although the sales to the public of appliances has become considerable—as can be seen from Fig. 4—the greater work is in serving the public with advice, dealing with inquiries about the supply of electricity, and handling the payment of accounts.

The service centres are now in the process of modernisation and Fig. 5 illustrates the new Adwick (Woodlands) service centre which was opened in 1959. The Thorne service centre has just been reconstructed, whilst plans have been drawn up for alterations to the Doncaster (Hallgate) service centre. A most important service rendered to consumers is that of maintaining their appliances and installations in good order. There are six vans which are employed regularly on service work. The service applies to the distant consumer as well as the neighbour to the service centre, and is particularly appreciated in the rural areas where electrical contractors are few and far between. The Board operates a domestic appliance maintenance scheme, under which approved appliances are maintained for a small quarterly charge. There are now over 3,000 consumers participating in this scheme.

N.C.B. Network Take-over

Following the decision of the N.C.B. to relinquish its distribution responsibilities to the respective Area Boards pressure was exerted by the public to urge the Yorkshire Electricity Board to take over the Edlington and Armthorpe networks. The negotiations were very difficult because of the age and nature of the networks and the need to embark on a big scheme of reinforcement in each case. The difficulties were patiently surmounted and the networks were taken over by the end of 1957, although a measure of improvement had been made early in 1957 by connecting the N.C.B. 3·3 kV cables to the Board's 11 kV system through transfer transformers.

The engineering work in taking over and remodelling a relatively undeveloped network (there were even a few load limiters still in use) can be well appreciated. It is not so easy to appreciate the extensive commercial work involved. In the first place it was necessary to make an inspection and test of every consumer's installation and report to the N.C.B. or other responsible party on the defects which required putting right. Later, it was necessary to obtain a supply agreement from every consumer and explain the Board's tariff which would replace the N.C.B. tariff. In general, the N.C.B. tariff was of the flat rate variety and was, consequently, very different in effect from the Board's two-part tariffs. After the take-over date was declared all the meters had to be changed. These projects involved taking on 4,231 consumers.

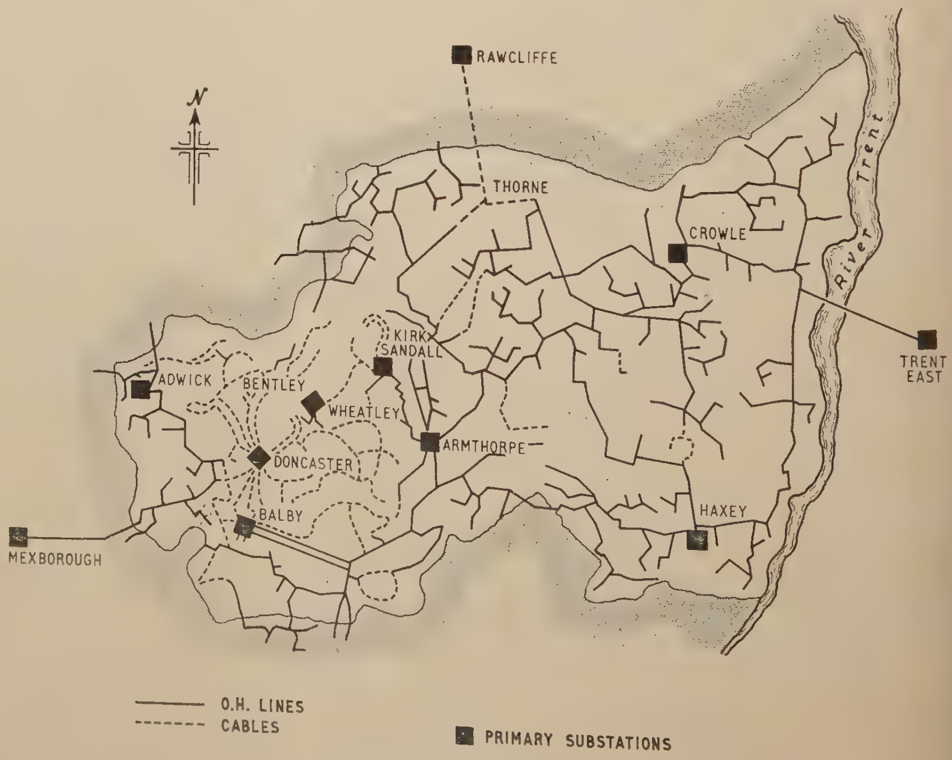


Fig. 3.—The e.h.v. network in 1960

All the original supply undertakings provided supply at 230 V or its equivalent, which meant that over 60,000 consumers had to be changed over to the national standard of 240 V when the operation became possible. This work had to be done at times to suit the technical requirements (until the Greyfriars Road power station was officially closed down the old generating plant exercised a limiting factor) and the last group of 29,000 consumers was changed over in June, 1960. The District is now completely standardised as regards the voltage of supply.

After vesting day there were several systems in being dealing with consumers' applications and records. These were gradually integrated and then transferred to a standard system of consumers' records which had been devised by the Board's commercial specialists at head office in 1953.

Every consumer is now supplied on one or more of the Board's seven standard tariffs and this state of affairs has existed for some years. At vesting day there were four groups of tariffs in the Doncaster District covering all classes of consumer, to say nothing of the many special tariffs which had been created to meet special needs or circumstances. Some of these special tariffs were not judged too harshly because in certain regions it had been possible for two undertakings to be in competition in respect of power supplies.

The task of a District organisation is to ensure that electricity and service is supplied to the consumer in compliance with the policies laid down by the Board in accordance with its powers under the Electricity Acts. Whilst it is at District level where the work done for electricity consumers can most easily be seen, it should be emphasised once again how this work depends on the prior and associated activities of the Sub-Area staff and the Area headquarters staff. Quite apart from the fact that District work can be carried out only under the authority granted by the higher levels there are many duties, such as accountancy, billing, wayleaves, etc., which are largely centralised. One important factor which must be mentioned is the help rendered whenever the District is in need. The need can take a great many forms and however competent a District may be it requires assistance continually. Indeed, it is one of the principal duties of the District staff to appreciate the point at which it is necessary to call for co-operation or assistance. What is at stake is not the question of the inability of the District to make a decision but the necessity to achieve the best solution from the Board's point of view. The evolution and development of the District could not have taken place so smoothly without this helpfulness and the guidance which goes with it.

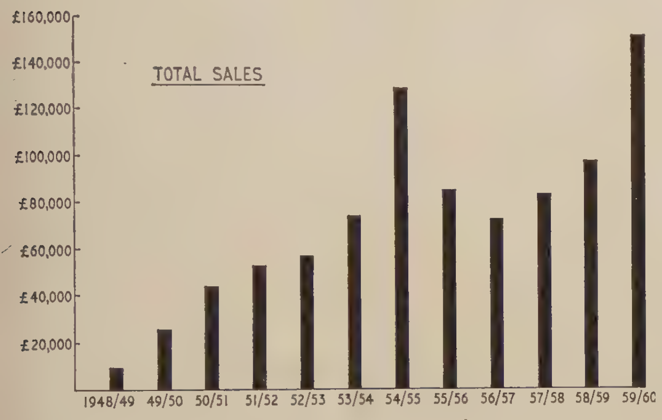


Fig. 4.—Domestic appliance sales

Fig. 5.—The Adwick (Woodlands) service centre was opened in 1959

The author desires to express his thanks to the chairman of the Yorkshire Electricity Board, Mr. D. Bellamy, C.B.E., D.L., F.A.C.C.A., for permission to publish this article.

General Requirements for Domestic Electrical Appliances

SEVERAL British Standards for electrical appliances have been re-issued as sections of B.S. 3456, the new " master " standard by which the British Electrical Approvals Board for Domestic Appliances judges products submitted to it for approval. The first new specification in the B.S. 3456 series has now been issued (" Testing and Approval of Domestic Electrical Appliances, Section A1: General Requirements "). It deals with general requirements for heating and cooking appliances supplied at 250 V or less, single-phase a.c. or d.c., and is concerned with electrical and mechanical construction insofar as these affect safety, durability and reliability in service. The specification also covers appliances incorporating a motor, but these must also comply with Part B, " Motor-Operated Appliances," where these are applicable. Electric heating and cooking appliances will only be considered to conform fully to B.S. 3456 if they meet the general requirements of Section A1 and the specific requirements of the subsequent section giving individual requirements for the particular appliance. An electric iron, for example, must comply with both A1 and A9 requirements. All appliances claimed to be manufactured to this standard must bear the mark of the British Electrical Approvals Board, which can be used only under licence from the Board.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 8s 6d each.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Office Lighting

IT has been stated that since the Government programme of essential legislation for the current session is already so full it has been reluctantly decided that there will not be time to introduce legislation on health, welfare and safety in shops, offices and railway premises during the present session. The Government's comprehensive Bill on the subject has therefore been deferred.

The Minister of Labour has said that the legislation will be introduced in the autumn of 1962 and that no action will be taken in the meantime to implement the Offices Act, 1960, which comes into operation on 1st January, 1962.

This decision has naturally caused disappointment. It should, therefore, be noted that it is only a postponement not an abandonment. In effect it changes nothing except that the most die-hard managements will have another year of grace before they are *compelled* to provide reasonable working conditions. It provides no grounds at all for putting off the improvements so badly needed in tens of thousands of offices and although no clue has yet been given as to the contents of the lighting regulations which will be made in due course, it is quite certain that if improvements are made now up to the standards of the 1961 I.E.S. Code there will be nothing to fear in this direction.

London, W.C.2.

A. Wilcock,
Director,
British Lighting Council.

"Dowsing" for Underground Cables

IT is of great interest to note the method of locating underground cables in your issues of 25th August and 8th September. Not very many engineers that I have met are aware of such a method, which is simple and useful. The results obtained, as I understand, are positive in most cases.

I would be obliged if Messrs. F. H. Pulvermacher and F. W. Bloore would let me have a sketch or a detailed description, explaining exactly how the two L-shaped copper rods are to be employed to get the desired result. The information contained in the letters of the abovementioned gentlemen is somewhat insufficient for those who are not conversant with the method. It will also be appreciated if the phenomenon responsible for the working of the device is explained.

I am sure that there are many other engineers who will be benefited by the illustration which Messrs. Pulvermacher and Bloore are requested to provide.

Calcutta, India. R. B. Dutt.

International Co-operation

ARISING out of the article, "Fifty-Year Retrospect of the B.E.A.M.A." in the *Electrical Review* of 27th October, I would like to remind you that, without in any way detracting from the great work performed by D. N. Dunlop in the organisation of the World Power Conference, it was not in fact, as is implied, the pioneer of international organisations for co-operation between engineers. I think that this distinction belongs to C.I.G.R.E. the first meeting of which was held in November, 1921, and was attended by 118 delegates from 12 countries.

The origin of the first C.I.G.R.E. meeting may be of interest. In point of fact it was intended to be a single meeting to assist European electrical engineers who were at that time much concerned with the reconstruction of the devastated countries in Europe, and it was felt that an opportunity should be created whereby they could secure the benefit of developments that had occurred in the unoccupied countries during that period.

The conference was in fact so successful that it was decided to hold a second meeting in 1923 and from then onwards it has been held biennially with the exception of the period covered by the second world war.

Leatherhead, Surrey. R. A. McMahon.

[Mr. McMahon is secretary of the British National Committee of C.I.G.R.E. (Conférence Internationale des Grands Réseaux Electriques).—Editors, *Electrical Review*.]

SOLAR ENERGY

NEW developments in the use of solar energy were described by Dr. H. Heywood at a meeting of the Royal Society of Arts in London yesterday (Thursday). The serious study of solar energy utilisation had begun about a hundred years ago, and some quite elaborate equipment had been built during the early years of the twentieth century. This had comprised water distilling plant, steam boilers and engines, hot air engines and even a solar-operated refrigerator in 1878. Most of the inventors during this period had used expensive mirror systems to generate steam and hence mechanical power.

The immediate scope had changed from power development to the collection of solar radiation as low-grade heat. This could be accomplished with relatively simple equipment and with a collecting efficiency of the order of 60 per cent or greater, whereas there were still many problems to be solved in the generation of solar power, which for inescapable thermodynamic reasons could only have an efficiency of the order 5-10 per cent. This low-grade heat might be used for domestic hot water supply, house heating, distillation to provide drinking water from salt water and eventually for air conditioning and refrigeration.

By using mirror systems to concentrate the radiation, higher working temperatures might be attained, ranging from the simple solar cooker to the elaborate solar furnaces which reached temperatures exceeding 3,000°C. The intermediate temperature range could be used for power generation by means of a heat engine cycle. Solar radiation could be converted directly to electricity by the thermo-electric process or by the comparatively recently-developed silicon solar cells, which at present constituted the power source for instruments in artificial satellites.

VIEWS on the NEWS

By "REFLECTOR"

IF anything, the National Coal Board is more annoyed by the oil companies' propaganda than is the electrical industry. But it really shouldn't be, for the advertisements do admit (in small type) that solid fuel is cheaper than oil for heating purposes. *Coal News*, the N.C.B.'s "newspaper of the mining industry," contends that coke at 10s a hundredweight gives the lowest weekly cost of heating water in the home with two or three radiators (11s 6d). Pursuing the comparison, *Coal News* sets out the following costs:—Oil 14s 6d, gas 16s 5d, and electricity £1 (a curiously round figure). Without agreeing with this, I may express thanks to the journal for putting oil in its place. The oil companies are using figures which purport to show that electricity is twice as dear as oil for heating. I have already said that the advertisements say nothing about the initial cost of the oil equipment. *Coal News* adds that the same silence is observed regarding the maintenance of burners, the cost of which it puts at "between 2s and 10s per week."

* * *

On past occasions I have made mention of the "unseasonable" peaks (from our point of view) which are experienced by many United States electrical utilities. The trend towards summer peaks continues and the *Electrical World* (New York) says that at the last count reports from 68 companies revealed that in 44 instances (68 per cent) the summer peak was higher than the peak load of the preceding winter. This appears to be due to what is termed "the northward march of air-conditioning load." It is strange to read that "in most sections of the country, peak loads were mildly disappointing. Only 40 per cent of the companies equalled or bettered pre-season estimates." Are our Electricity Boards disappointed (even mildly) when the peak is not so great as they anticipated ?

* * *

Some Electricity Boards, standing on their undoubted rights, are apt to be rather short with consumers who delay payment of their bills and threaten to cut off their supplies. I can understand their attitude, for some people have to be frightened into paying up. Sometimes, of course, accounts are inadvertently overlooked and then the delinquents naturally feel aggrieved at being threatened. This matter has cropped up in the North Western Area where the Consultative Council has been told that "if a private supplier sent notices to his customers in that tone and so soon after the account became due he would very soon be out of business," reports the *Manchester Evening News*. As a result of this representation the Council is "to think again to find a suitable form of words."

* * *

An electric fire described in the *Guardian* is said to have "the British Electricity Board's seal of approval for electrical appliances." How seldom does the lay Press get electrical terms correct. Surely a reputable newspaper can obtain advice on such matters. But even periodicals published within the industry are not free from this sort of thing. I read in *Power News* (the C.E.G.B. journal) that Mr. D. W. Maddocks, who has been appointed director of labour and welfare of the North Western Region, "started with the Derby Electricity Board in 1939."

* * *

The unregenerate Ebenezer Scrooge would have commended the Merseyside and North Wales Electricity Board for its decision to increase its charges for electricity used for Christmas illuminations. Local traders are not so pleased. The Bold Street, Liverpool, Association refutes the Board's statement that the illuminations are switched on at times of heaviest demand, saying that they are purely an off-peak load. The protest of the Birkenhead Traders' Association was milder, but I note from the *Liverpool Daily Post* that the identity of the person chosen to switch on the illuminations in Birkenhead is to be kept secret until the time of the actual ceremony. It would be a real surprise if he turned out to be the chairman of "M.A.N.W.E.B."

* * *

From the *Electrical Review* of 13th November, 1891:—

> "Electricity as an Adjunct of Adulteration.—At the meeting of the Bavarian Society of Applied Chemistry, held last month in Augsburg, the subject of the presence of copper in preserved vegetables was under discussion. . . . One of the speakers, Director Kochler, of Berlin, made a rather remarkable statement. He said that during a visit to the Strassburg Exhibition his attention had been attracted to the remarkably beautiful green colour of some preserved beans, and upon inquiring as to how this colour had been imparted he was told that it was a trade secret. Subsequently he had learned that during the boiling of these vegetables in a copper vessel an electric current was passed through the whole, the copper of the vessel acting as an anode, and that in this way a large quantity of copper was carried into solution, giving the vegetables a fine tint."

Engineering in Europe

ABSTRACTS FROM FOREIGN TECHNICAL JOURNALS

THE problem of temperature distribution in oil-filled bushings is of particular importance owing to the continuous increase of current and voltage ratings. Of special interest is the temperature distribution under the effect of the voltage and simultaneous current passage through the conductor when the lower portion of the bushing is heated by the oil filling. A series of measurements by thermocouples were carried out on a model of a 220 kV bushing from which it was found that the oil is the main factor determining the temperature distribution. It is necessary that the design of the bushing permits the oil to circulate throughout the body. This equalises the temperature of the insulator over the whole volume and creates a form of thermal screen, preventing excessive temperature rise in the lower part. In this way, current overloads do not represent a particular danger. If correct circulation is unobtainable, the conductor section has to be increased to render overloads harmless.

An important effect of circular oil flow is efficient cooling in a radial direction, thus reducing the maximum temperature and preventing the heat flow in a single direction, i.e. towards the top. Heat transfer in an axial direction is due to the oil movement in the ducts. The equalising electrodes have only a secondary effect, and there is a considerable temperature gradient along them, although the voltage applied produces uniform conditions of heating along the electrodes; the electrode edges are at a lower temperature, probably because the surrounding parts are outside the electric field. If the lower part of the bushing is not heated, the non-uniformity of the temperature rise of the bushing increases, yet the maximum temperature in the upper part is less than if the lower part were heated by an overload. Therefore such operating conditions are not dangerous for the bushing. All the experiments showed that well-designed oil-filled bushings for 220 kV with truly circular oil flow remain within the temperature limits established by the standards GOST 8024-56 even under sustained current and voltage overloads.—" Temperature Rise of Oil-Filled Capacitor-Type Bushings," by A. F. Kalachikhin, *Vestnik Elektroprom.*, No. 6, 36-41, 1961, in Russian.

Corona Investigations

Investigations of corona and other gas discharges are mostly experimental. This is partly due to the fact that the theoretical study is based simply on Poisson's equation in which a certain number of measurable or assumed characteristic constants, such as ion mobility and re-combination factor and electron charge are introduced (probably only the most important of many more factors effecting the actual phenomenon) are included and for which more or less simplified boundary conditions are found. Also, it is clear that the actual conditions of corona in power systems vary a great deal more than the results found on various laboratory models. The main purpose of all these investigations is obviously to obtain general relationships for the corona phenomena and also quantitative characteristics which can be applied to practical problems (such as corona losses on v.h.v. lines).

The use of similarity considerations enables this problem to be solved and a fairly convincing demonstration of the existence of general relationships for corona processes to be obtained. It becomes possible to convert results obtained on d.c. corona to applications on a.c. transmission lines, and results obtained in low lands to lines running over mountains. The difficult part is to derive the correct criteria of similarity. The author succeeds in obtaining the full set of these criteria, from which the equivalent forms of Poisson's equation follow for d.c. and a.c. corona. These can be represented by a single non-dimensional equation. The comparison of results of laboratory tests, converted to this form of representation, can be actually arranged along one continuous curve, this proving the identity of the basic phenomena, whatever the apparent differences due to secondary factors. It is also proved that air pressure has no influence at all on corona phenomena. —" Methods of Generalising Experimental Results of Corona Investigations," by V. I. Levitov, *Elektrotechn. Obzor,* Vol. 50, No. 7, pp. 353-357, July, 1961, in Czech.

Prestressed Concrete Line Supports

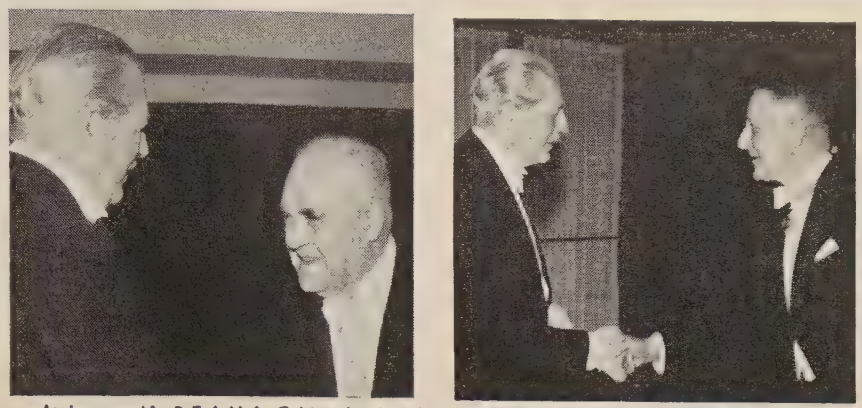
Although frequently employed in various countries, the use of prestressed concrete as a material for overhead line supports does not seem to have become so widespread as could have been expected, despite the fact that such supports need not be appreciably dearer than reinforced concrete poles, whilst being considerably stronger and safe against cracking. Also, their technology is quite simple, as is shown in this paper, using a technique which assures optimum performance of the concrete and the steel reinforcement. The simple principle of prestressing, which means only pre-compacting or pre-compression during the casting of the poles, renders the finished support almost homogeneous and thus imparts to it a relatively high degree of tensile strength and elasticity.

The most important characteristic is resistance to cracking, which is the greatest danger for ordinary ferro-concrete poles, since cracks open the way to penetration of moisture to the steel reinforcements, with subsequent rusting of the latter, loss of strength and eventual failure of the poles under their load. Whilst theory and test results are given in full detail, unfortunately only little is reported on results obtained in practice with this technique, though it is known to have been used in France, Belgium and some other countries for at least ten years.— " Prestressed Concrete Supports," by H. Lohest, *Bull. Sci. Ass. Ing. Elect. Montefiore,* No. 4/5, pp. 225-250, April/May, 1961, in French.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review.*

PERSONAL AND SOCIAL

News of Men and Women of the Industry



At last week's B.E.A.M.A. Golden Jubilee dinner; (left) the President, Mr. A. M. Browne, receives the Prime Minister; (right) Mr. Macmillan with the Director, Mr. Stanley F. Steward

The Brush Electrical Engineering Co., Ltd., announces the appointment to the board of **Mr. F. H. Wood,** M.I.Mech.E., M.I.Loco.E., **Mr. L. R. Blake,** Ph.D., B.Sc. (Hons.) Eng., A.M.I.E.E., and **Mr. R. A. Grierson,** M.I.E.E., M.I.Prod.E.

Mr. Wood began his career as an apprentice at W. G. Bagnall, Ltd., and in 1952 he joined Brush-Bagnall Traction at Loughborough as chief mechanical designer. In 1955 he undertook the additional duties of chief contracts engineer and in 1957 became manager, Traction Division. He was appointed executive director in 1960.

Dr. Blake was head of the Electrical Section Research Laboratory of B.T.H., Rugby, from 1949 to 1956, when he joined the United Kingdom Atomic Energy Authority. He became an executive director of the Brush Company last April. Dr. Blake is also director of engineering.

Mr. Grierson served his apprenticeship at the Electric Construction Co., Ltd. From 1939 to 1943 he was with the British Electric Resistance Co., Ltd., and from 1943 to 1947 with Partridge Wilson & Co., Ltd. After joining Brush in 1948, he served in various capacities, and immediately before his appointment as director he was manager of the Transformer and Switchgear Divisions.

As we have already reported, **Mr. L. C. Penwill,** C.B.E., Companion I.E.E., is retiring on 2nd February next from the position of director and secretary of the Electrical Contractors' Association and its allied organisations. Mr. Penwill joined the staff of the three associations in 1920 as assistant secretary under Mr. L. G. Tate, the chief executive official. When Mr. Tate died suddenly in 1926 Mr. Penwill became secretary and he was appointed director in 1930.

Mr. G. T. King, A.M.I.C.E., A.M.I.Mun.E., Barrister-at-Law, has been appointed secretary of the three associations in succession to Mr. Penwill. Since 1955 Mr. King has been technical executive officer with the Association of British Chemical Manufacturers. He previously held appointments with the municipal authorities of Chichester, Torquay, Eastbourne and Poole and with the East Suffolk and Norfolk River Board. Mr. King served his articles with the surveyor to the Barnstaple U.D.C. and the city engineer of Exeter. He is a former member of the Council, prizeman and medallist of the Institution of Municipal Engineers.

Mr. B. E. Gray was appointed assistant secretary of the associations on 1st October last. He has been with the E.C.A. for nearly twenty-one years and for the past eleven years has served as editor and publicity manager and secretary of the Technical and Publicity Committees.

Mr. R. E. Ansell has been appointed sales director of Henry Wiggin & Co., Ltd., and **Mr. C. Bowles** becomes sales manager.

On 1st November **Arrow Electric Switches, Ltd.,** entertained some 200 of their customers and friends at a party at the Queen's Hotel, Birmingham. The guests were received by Mr. T. S. Crabtree, managing director, and Mr. B. C. Skinner, sales director, in company with their executive staff and their representatives from the London, Southern Counties, Birmingham and Lancs./Yorks. areas.

Mr. L. C. Penwill

Mr. G. T. King

Mr. B. E. Gray

Mr. E. K. Cole has resigned as a director of British Electronic Industries, Ltd., and E. K. Cole, Ltd. Mr. Cole founded the E. K. Cole business in the 1920's and was chairman of the company when it merged with Pye, Ltd., to form British Electronic Industries, of which Mr. Cole was appointed deputy chairman.

Mr. L. H. Aspinal has retired from the transformer engineering department of the A.E.I. (Rugby), Ltd., Transformer Division. Mr. Aspinal joined the British Thomson-Houston Company at Rugby as an apprentice in July, 1913, and since 1929 has designed all sizes of transformers up to 150 kV. To mark his retirement Mr. Aspinal was presented with a set of tools and an autographed album from his colleagues and friends at Rugby.

Mr. R. L. Cochrane, LL.B., A.M.B.I.M., has been appointed divisional administrative officer of the C.E.G.B. South Wales Division, consequent upon the appointment of **Mr. G. Newman,** F.C.I.S., M.B.I.M., D.P.A., Barrister-at-Law (who has been divisional secretary since 1959) as the administrative officer in the Secretary's Department at the London headquarters of the Board. The appointment of a divisional administrative officer is in line with the changed pattern of organisation. Mr. Cochrane will be responsible to the assistant regional director for the administrative functions and remaining accountancy functions in the Division. The estates and wayleave duties and those aspects of personnel functions previously carried out within the Divisional Secretary's Department will be transferred to the regional secretary (Mr. H. W. Carter) and regional personnel officer (Mr. G. O. James, A.M.I.E.E.), respectively.

Brigadier John Clemow, formerly chief engineer, weapons, and a special director of Vickers-Armstrongs (Aircraft), Ltd., has been appointed engineering director of G.E.C. (Electronics), Ltd. Brigadier Clemow was a scholar of St. John's College, Cambridge, and he became a Wrangler in the Mathematical Tripos. After army service he joined the Ministry of Supply in 1944 as chief design officer, armament design department. He worked at the R.A.E. Farnborough from 1948 to 1951 when he became assistant director, guided weapons projects, at Ministry of Supply headquarters. In 1953 Brigadier Clemow was lent to the Fairey Aviation Company as head of its guided weapon team, but returned to the Ministry of Supply as director of guided weapon projects in 1955. He retired from the Army on joining Vickers in 1957.

Brigadier J. Clemow

Mr. Norman Care, M.I.E.E., M.B.I.M., general sales manager, Aberdare Holdings, Ltd., and general manager, South Wales Switchgear, Ltd., has been appointed a director of the Neckar Water Softener Co., Ltd., a member company of the Aberdare Group.

Brigadier A. E. M. Walter, C.B.E., M.Inst.T., has been appointed full-time chairman of the United Kingdom Railway Advisory Service. Brigadier Walter had a distinguished military career after training with the London & North Eastern Railway and several of the principal electrical manufacturers. The U.K.R.A.S. not only advises British Railways; it regularly provides consulting services by correspondence to railways throughout the world.

The inauguration of **Mr. W. T. Souter,** F.I.E.S., as president of the Illuminating Engineering Society for 1961-62 means that his firm (Holophane, Ltd.—Mr. Souter is joint managing director) has now provided the sixth director to hold this office. The picture shows the last four who have been I.E.S. presidents and was taken during a recent presentation ceremony to Dr. S. English on his retirement as chairman of Holophane, Ltd.

I.E.S. presidents (left to right); Mr. W. T. Souter, Mr. J. G. Holmes (pres. 1951-52), Dr. S. English (pres. 1938-39), and Mr. H. G. Campbell (pres. 1959-60)

The Reginald Mitchell Memorial Gold Medal of the Stoke-on-Trent Association of Engineers is this year being awarded to **Sir Christopher Hinton,** K.B.E., F.R.S., M.A., chairman of the Central Electricity Generating Board. The presentation will take place in the Victoria Hall, Hanley, on 15th November at 7.30 p.m., following which Sir Christopher will deliver the Mitchell Memorial Lecture on "Electrical Power in England and Wales."

Mr. Peter B. Wood has been appointed chief accountant in the treasurer's department of Associated Electrical Industries, Ltd. Mr. Wood joins A.E.I. from Crompton Parkinson, Ltd., where he was comptroller.

Mr. G. W. Moore, Associate I.E.E., M.A.M.E.M.E., left last Monday to take up his appointment as assistant general manager with the newly formed Electricity Corporation of Libya. His headquarters will be in Tripoli. From 1954 to 1958 Mr. Moore held the post of chief electrical and mechanical engineer with the Directorate General of Municipalities, Ministry of the Interior, Iraq. Mr. Moore received his early training in South Wales and was for several years with the Central Electricity Board, London and South East England Area.

Mr. G. W. Moore

Mr. W. A. E. Brown, A.M.I.E.E., has been appointed Kent sub-area engineer, South Eastern Electricity Board, in succession to the late Mr. J. H. Blackmore. Mr. Brown began his career in the electricity supply industry in 1934 with the London and Home Counties Joint Electricity Authority and on returning from war service he became assistant mains engineer at Twickenham. Later he served in the Kent and Surrey Sub-Areas of Seeboard, becoming senior assistant engineer (development and planning) in the latter Sub-Area in 1959.

OBITUARY

Mr. P. T. Davies, B.Sc., A.M.I.E.E., manager of the Switchgear Department of Johnson & Phillips, Ltd., since 1956, died suddenly last Monday. Mr. Davies, who was fifty-five, was educated at the University College of Wales (Swansea) and received his training with the English Electric Co., Ltd., at Stafford, later holding various positions in the company's switchgear organisation and also as its technical representative with the Westinghouse Corporation in the United States. He left the English Electric Co. to join the Brush Electrical Engineering Co., Ltd., as general manager of its factory in Cardiff in 1950, and from 1954 to 1956 he was with South Wales Switchgear, Ltd.

Mr. J. P. Gregory, B.Sc.(Eng.), A.M.I.E.E., assistant manager at Rugby of the Control Gear Engineering Department, A.E.I. Motor and Control Gear Division, died on 31st October at his home at Leamington Spa. He was 47. Mr. Gregory was educated at Mill Hill School and University College, London. On completion of a student apprenticeship with the British Thomson-Houston Co., Ltd., he joined the Control Gear Engineering Department where he specialised in industrial contactor control.

Signor C. Semenza.—One of the world's most prominent hydro-electric engineers, Signor Carlo Semenza, died in Venice on 31st October at the age of sixty-eight. He was responsible for dams and water-power stations in many countries and was director of the hydraulic engineering service of the Società Adriatica di Elettricità. Signor Semenza was a prolific writer on hydro-electric subjects and he was prominent in international power conferences.

INDUSTRIAL NEWS

Electricity Supply Investment

INVESTMENT by the electricity supply industry next year is likely to rise by over 10 per cent compared with a rise of nearly 5 per cent in total investment by the public services, nationalised industries and public corporations.

Total expenditure by the electricity supply industry in the year 1962-63 has been approved at £397 million compared with an estimated expenditure of £363 million in 1961-62 and £336 million in 1960-61. Total expenditure by the nationalised industries and public corporations next year has been approved at £915 million and expenditure on public services at £925 million.

A White Paper* published last week says that the increase of £85 million in total expenditure would have been greater but for action in the summer to relieve the pressure of internal demand. Where there is an expected fall in expenditure this is "either the continuation of a general downward trend, as in the case of the National Coal Board and the Atomic Energy Authority, or the product of special circumstances."

In 1960-61 total fixed investment by the Central Electricity Generating Board and the Area Boards in England and Wales was £3·1 million more than estimated a year ago (*Electrical Review*, 4th November, 1960) and the present estimate for 1961-62, at £315·7 million, is £11·3 million higher than the estimate given last November. This increase is due to a rise of £5 million in expenditure by the C.E.G.B. on nuclear power stations, brought about by an alteration in the incidence of expenditure over the years, and a rise of £6·3 million in expenditure by the Area Boards resulting from the unexpectedly high rate of load growth and increased costs. A fall in the expenditure on nuclear fuel means that total expenditure, at £324·5 million, will be £6·5 million above last year's estimate.

At the end of 1961 the output capacity of the Board's stations is expected to be 29,300 MW and 31,800 MW a year later. It is expected that well over 12,000 MW of new plant will be commissioned in the years 1961-65. Proposals for a further increase in capacity, which would involve initial expenditure in 1962-63, have recently been made and are under consideration.

Expenditure by the South of Scotland Electricity Board on fixed assets in 1962-63 is approved at £22 compared with £25·5 million in 1961-62. A further £5·5 million is needed next year for initial nuclear fuel charges and this will bring the total up to £27·5 million. There is a slight rise (£8 million to £8·2 million) in investment in distribution, but capital expenditure on conventional stations (£4·5 million), nuclear stations (£5·8 million) and main transmission (£3·5 million) will be less than this year. Work on the second half of Kincardine power station "is proceeding satisfactorily," and one 188 MW set is expected to be commissioned in 1962 and another in 1963. The two reactors at Hunterston are also due for commissioning in 1963.

The North of Scotland Hydro-Electric Board are planning to spend £13·5 million in 1962-63 compared with £12·8 million this year. Generation takes £8·9 million (£8·7 million), transmission £1·5 million (£1·3 million) and distribution £3·1 million (£2·8 million). Expenditure on generation continues to be mainly on the Loch Aire and Strathfarrar schemes in which troublesome rock conditions are causing some delay.

Capital expenditure by the gas industry next year is likely to rise by nearly £2 million to £48·8 million. Post Office expenditure is planned to increase by £11 million to £118 million, and against a fall of nearly £4 million to £139·6 million in expenditure by British Railways, London Transport expect to spend £16·3 million in 1962-63 compared with £15 million this year. Expenditure by the Atomic Energy Authority is expected to fall from £36·1 million this year to £32·4 million in 1962-63.

ELECTRICITY COUNCIL AND BOARDS IN ENGLAND AND WALES

	1959/60	1960/61	1961/62	1962/63
	£ million			
Central Electricity Generating Board				
Generation:				
Conventional stations	118·2	105·8	99·0	87·0
Nuclear stations	57·7	53·5	63·0	70·0
Main transmission	35·1	31·2	39·0	55·0
Other	3·7	5·7	5·0	5·0
Total	214·7	196·2	206·0	217·0
Area Boards (distribution)	96·6	98·7	109·7	117·9
Total fixed assets	311·3	294·9	315·7	334·9
Nuclear fuel (initial charges)	6·5	2·8	8·8	20·6
Total	317·8	297·7	324·5	355·5

The net book value of fixed assets shown in the balance sheets of the Electricity Council and Boards at 31st March, 1961, was £2,030 million.

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* "Public Investment in Great Britain, October, 1961," Cmnd. 1522, H.M. Stationery Office, price 2s 3d.

RECORD VALVE BUSINESS

Mr. F. Burgess, chairman of the British Valve Manufacturers' Association, stated at the Association's annual general meeting on 31st October that it appeared likely that in 1961 the U.K. valve industry would produce a greater value of valves than the record 1960 figure of £38·2 million. Output was up by more than 10 per cent in the first half-year of 1961 compared with the same period last year and valve exports were also greater. A recent inquiry to member firms in October had shown that compared with six months earlier the rate of total new orders was, in general, higher; the value of uncompleted orders was approximately the same for non-ferrous valves and only slightly higher for ferrous valves; and the monthly level of output was, in general, higher, but was limited in some cases by a shortage of skilled labour.

The majority view was that general business activity in the valve industry during the next six months would remain about the same as at present. In assessing the situation as being not unsatisfactory, Mr. Burgess said that in general profit margins had fallen rather than risen.

At the meeting Mr. A. Robertson (managing director, Glenfield & Kennedy, Ltd.) was elected chairman of the Association for the year 1961-62 with Mr. F. Burgess (managing director, Whites-Munan, Ltd.) as vice-chairman.

B.E.A.M.A. Publicity Conference

In line with the other golden jubilee celebrations of the British Electrical and Allied Manufacturers' Association, the emphasis of the sixth B.E.A.M.A. Publicity Conference was on export. The conference was held at the Connaught Rooms, London, on Tuesday and Wednesday morning of this week and a report of the proceedings will appear in our next issue.

Dock Distribution Scheme

THE first stage of the Port of London Authority's programme for the modernisation and development of Tilbury Docks was officially inaugurated on Monday when Councillor S. G. S. Gooderham, J.P., chairman of Thurrock Urban District Council, brought into operation the new electrical network. Since the war demands for electrical power at the docks have increased to a point approaching the maximum supply available and in 1959 a £250,000 new distribution system was started.

Power, received from the Eastern Electricity Board at 33 kV, is transformed to 11 kV before being fed to the Port Authority's underground main ringing the docks. This serves five substations where the supply is transformed to 415 V three-phase and 240 V single-phase for direct distribution to cranes, pumping plant, quays, ship repair works, dry docks and offices, etc. Additionally two of the substations are equipped with mercury arc rectifiers from which 500 V d.c. can be distributed. The new installation, which has doubled the previous available supply, has been designed for all foreseeable demands over the next 10 to 15 years.

An interesting feature of the system is a mosaic diagram of the distribution system which shows at a glance, by various coloured lights, correct operation or fault in any distribution switch in any section of the system.

G.E.C. Installation Equipment Group

All export operations of the General Electric Co., Ltd.'s Installation Equipment Group will in future be conducted from Perivale. Mr. W. A. Jordan, export manager for the Group, will be assisted by Messrs. A. Loryman and K. J. Shrives. The equipment they will be exporting includes electrical and bell accessories, switchfuses and other switchgear, conduit, trunking, duct and wiring accessories. The full address of the Export Division is Horsenden Lane South, Perivale, Greenford, Middlesex (telephone: Alperton 2831).

Decline in Domestic Refrigerator Deliveries

According to figures issued by the Domestic Refrigeration Development Committee, September deliveries to the home market of British-made domestic refrigerators totalled 23,128. This represents a decrease of 15 per cent compared with September, 1960, but dealers' stocks are diminishing and the public demand remains good.

Total deliveries to the home market in the first nine months of 1961 were 718,352, which, though a decrease of 13·7 per cent on the January-September period of 1960, is still 3·4 per cent up on the same period of 1959.

The decline in exports, due to the rising costs imposed by Government restrictions on the home market, continues. Deliveries overseas for September were 8,330, 28 per cent less than in September, 1960. The export total for the first nine months was 99,926, a decrease of 6·3 per cent compared with the same period of 1960.

E.W.F. Annual Dinner

The annual dinner of the Electrical Wholesalers' Federation is to take place on 22nd March at the Dorchester Hotel, London, W.1. It will be preceded by the Federation's annual meeting at the Park Lane Hotel, London, W.1.

B.S.I. CHANGES

CHANGES have been announced within the technical directorate of the British Standards Institution. The number of technical sections has been increased from five to seven, the two new ones being concerned with (a) metallurgical and some engineering industries and (b) safety and consumer standards; codes of practice work is now combined with building activities.

There are concomitant staff changes. Mr. Gordon Weston, now technical director, has been appointed associate director; Dr. H. M. Glass, deputy technical director, becomes technical director; Mr. J. F. Stanley, divisional chief technical officer for electrical and related projects, is now deputy technical director (electrical); and Professor C. A. Geneve, divisional chief technical officer in charge of codes, personal safety, metallurgical and other standards work, is appointed technical adviser (special duties) and will be primarily concerned with developing standards projects for refrigeration, shipbuilding and structural work.

Five former senior technical officers are now promoted to divisional chief technical officers with responsibility for one of B.S.I.'s main channels of work. They are Messrs. R. Berry, P. Bingley, J. Brown, R. A. McKinstry and A. F. B. Nall.

Australian Power Station Order

A £4 million order for two 350 MW steam turbines for the Munmorah power station has been awarded to the English Electric Co., Ltd., by the Electricity Commission of New South Wales. The first machine is scheduled for commercial operation in November, 1966, and the second a year later.

The two 3,000 r.p.m. single line reheat steam turbo-generators will be the most powerful to be installed in Australia, and are similar to the 350 MW units now on order from English Electric for the C.E.G.B. Drakelow "C" and Blyth "B" power stations.

The Munmorah station, to be built between Lake Munmorah and Lake Budgewoi, will be about 10 miles away from the Vales Point power station, for which English Electric are supplying three 200 MW units. The sets will be made at the company's Rugby works.

E.P.E.A. Residential School

The Electrical Power Engineers' Association has recently concluded a three-day residential school at Llandudno at which the following papers were read:—"The Finances of Electricity Supply," by Mr. R. S. Edwards, chairman-designate, Electricity Council; "The Principles and Practices of Collective Bargaining for Salaries and Conditions," by Mr. H. Norton, general secretary, E.P.E.A.; "History and Evolution of the E.P.E.A.," by Mr. A. M. F. Palmer, editor, publicity and research officer, E.P.E.A.; and "E.P.E.A. Work from the Area Office Point of View," by Mr. G. Millett, northern area secretary, E.P.E.A.

Each lecture was followed by questions and discussion in which students freely took part. Scholarships to the school were granted on E.P.E.A. section or branch nomination and awarded by the divisional councils of the Association. The school is the first of its kind in the history of the E.P.E.A. and is intended to assist, among other things, the development and training of future Association leaders.

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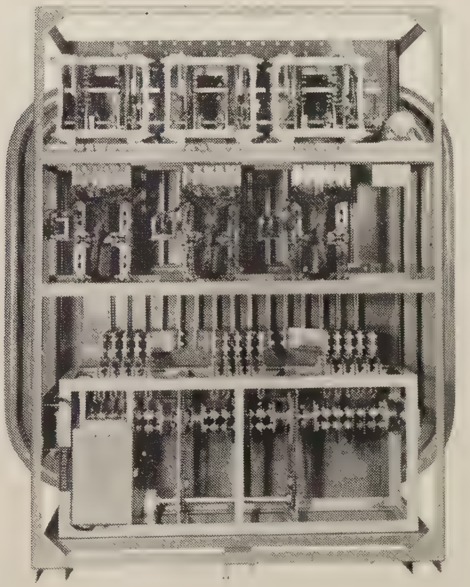
how to control the intense heat required for processing steel? Foster Transformers supplied the answer —as they have for other furnace equipment —a voltage regulator giving smooth control from 50 to 450 volts output, 650kVA.

The Foster Voltage Regulator Section supply all branches of industry, at home and abroad, with standard and custom-built equipment manufactured at their Wimbledon Works. The most exacting demands of industry are well met by Foster Transformers.

3-Phase Voltage Regulator. Ratio 11,000/450-50 volts. Output, 650kVA. Supplied to Birlec-Efco (Melting) Ltd. of Staffordshire.



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The installation is protectively controlled by a Crabtree Type C-50 flush consumer's unit so handsomely styled that it can be mounted where every advantage can be taken of the fuseless circuit-breaker control.

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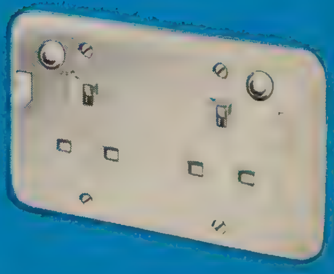

This Crabtree twin switched socket-outlet offers easily accessible and individual switch control and neon lamp indication—enhancing the convenience of the ring circuit.

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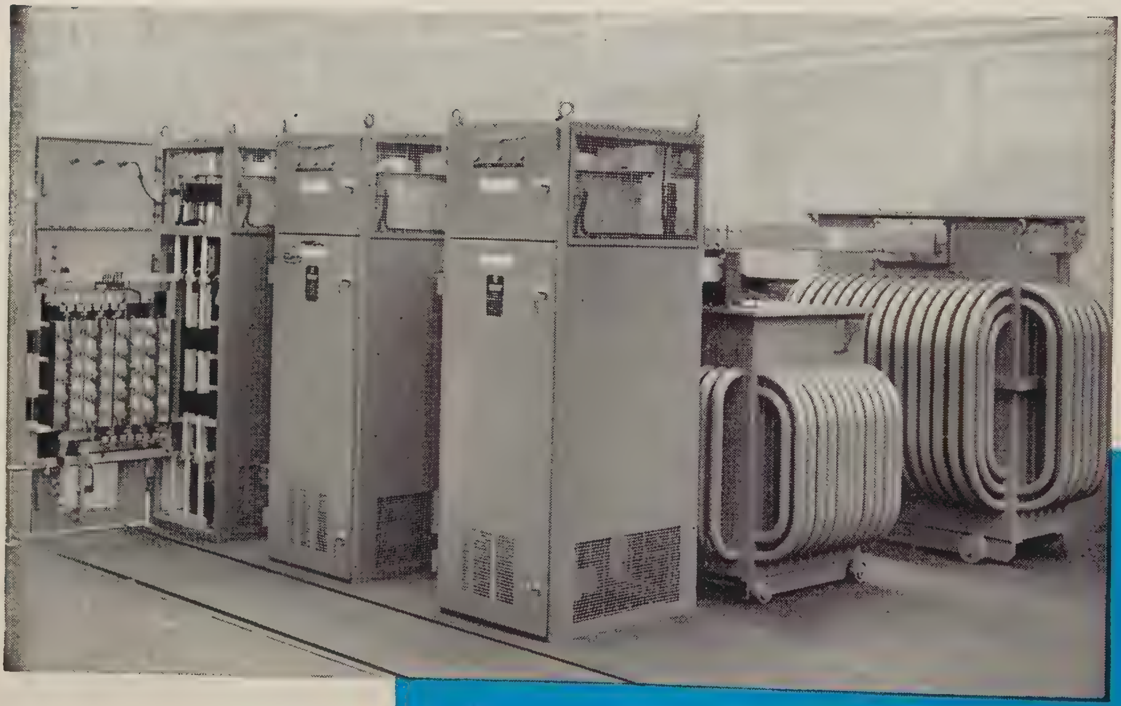

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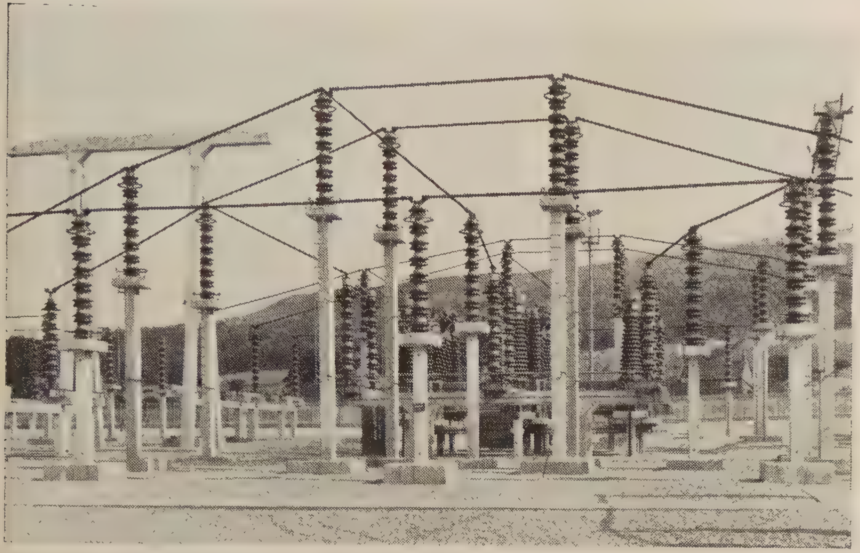
3244

275 kV Reinforcement

THE Central Electricity Generating Board's plan for system reinforcement in N.E. England includes the building of a double-circuit 275 kV supergrid line with three new 275/66 kV switching stations. The line, now nearing completion, runs south from Blyth to supply infeed points at West Boldon and Hart Moor, in County Durham, and Lackenby, near Middlesbrough. From Lackenby, the line is connected into the existing Monk Fryston/Stella West feeder. A. Reyrolle & Co., Ltd., are supplying the 275 kV 7,500 MVA type OB30 air-blast switchgear for the West Boldon and Lackenby installations and also the 66 kV 2,500 MVA OS10 switchgear ordered by the North Eastern Electricity Board for all three stations.



Part of the 275 kV switchgear compound at the first substation to be commissioned, at Lackenby, for a double-circuit 275 kV line in North-East England

RECENT ORDERS

AN order valued at over £100,000 for the supply of electrical equipment for 13 trawlers to be built in Poland has been obtained by Laurence, Scott & Electromotors, Ltd. The equipment for each vessel includes one 240 kW and one 120 kW variable-speed shaft-driven generators, one 300 h.p. trawl winch motor, two 120 kW diesel-engine driven auxiliary generators and all the associated control gear. The two shaft-driven generators will be coupled through reduction gearing to the main propulsion engines, which are to be manufactured by Mirrlees, Bickerton & Day, Ltd.

Among vessels recently launched embodying equipment supplied by W. H. Allen, Sons & Co., Ltd., is the new 10,000-ton passenger vessel s.s. *Funchal*, launched at the Elsinore Shipyards in Denmark, for the Empresa Insulana de Navegacao. The equipment comprises three 720 kW c.m.r. self-contained condensing turbo-alternators. Each turbine drives an A/S Titan alternator at 1,500 r.p.m. through Allen top-pinion parallel-shaft speed-reduction gears. The turbines run at 9,000 r.p.m. with steam at 560 p.s.i.g. and 840°F. The turbines, gears and condensers were built under licence by the Elsinore Shipbuilding & Engineering Co., Ltd., to the design of W. H. Allen, the principal components being supplied by the licensers.

Volta River Scheme Inquiry

An American mission headed by Mr. C. Randall, a leader of the United States steel industry, has been reviewing the position in Ghana in relation to the United States participation, to the extent of about $133 million, in the Volta River hydro-electric project. This scheme is linked with the establishment of aluminium smelting works by the specially-formed Volta Aluminium Co. in which the Kaiser Aluminum Co. (U.S.A.) has the principal holding. A contract for the construction of a dam and power station has already been awarded to an Italian consortium. Apart from the American financial participation, the World Bank and Great Britain have promised assistance.

Underground Railway for Montreal

The Montreal correspondent of *The Times* reports that the city, which has the largest population in Canada, is at last to have a much needed underground railway system. It will consist of three lines covering 21·4 miles connecting the greater part of the metropolitan area and some of the other suburbs with central Montreal. The whole scheme, announced by Mr. Jean Drapeau, the Mayor, will cost just over £50 million. The work of construction will start early next spring and it is hoped that trains will be running within four years.

YUGOSLAV PAPER MILL CONTRACTS

A contract worth about £300,000 for the major part of the electrical equipment in a new pulp and paper mill to be built in Yugoslavia has been awarded to the English Electric Co., Ltd., by Millspaugh-Wimpey, Ltd. The equipment, consisting of power distribution gear and motors for driving the process machinery, will be delivered by mid-1963 and will include a 35 kV outdoor substation consisting of three oil circuit-breakers and a 10 MVA transformer to step the supply down to 10 kV. Power will be distributed by the main switchboard and some 21 substations and transformers in the factory. Variable speed drives for the process machinery include one of 850 h.p. for the paper machine (designed to produce 100 metric tons of sack kraft and kraft liner a day), one of 80 h.p. for the pulp machine and one of 105 h.p. for the rewinder. There will also be some 380 constant speed a.c. motors.

G.E.C. (Engineering), Ltd., has also received an order which is worth about £130,000 for a 7 MW double-passout condensing turbo-generating set for installation in a pulp and paper mill at Plaski, Yugoslavia. It forms part of a £3 million contract which Millspaugh Wimpey has received for plant for the same mill. Delivery is scheduled for early 1963.

Anglo-Swedish D.C. Transmission Agreement

An agreement for the exchange of patents and patent rights relating to high voltage d.c. transmission has been arrived at between the English Electric Co., Ltd., and Allmänna Svenska Elektriska Aktiebolaget (A.S.E.A.), Sweden.

EUROPEAN WHOLESALERS' COLLABORATION

MUCH was said at this year's annual dinner of the Electrical Wholesalers' Federation about that body's link with the European Union of Electrical Wholesalers. Last month the Executive Committee of the Union met in London under the chairmanship of Mr. R. F. van Heusden, the president, and all the member countries—Austria, Belgium, Finland, France, Great Britain, Holland and Switzerland were represented.

Among the subjects discussed was the increasing value of business handled by electrical wholesalers in both installation equipment and domestic electrical appliances and each delegate submitted a report on the situation in his own country. It was brought out that while business in installation equipment was satisfactory and expanding, the field of domestic appliances presented certain difficulties to which the member countries of the Union were trying to find constructive solutions.

Relations between manufacturers and wholesalers in various countries were said to be close and cordial and it was agreed that the countries within the European Union should exchange information about the policy of manufacturers in these countries so that each country would be able to work more constructively towards establishing a European market where the electrical wholesale trade would effectively perform its proper function. Relations between wholesalers, contractors and retailers were also considered.

The next meeting of the Executive Committee will be held in Düsseldorf on 31st January and 1st February, 1962, and the next general assembly of the Union will take place in Brussels from 12th to 15th June, 1962, an entire day being devoted to meetings of three working groups each examining particular problems.

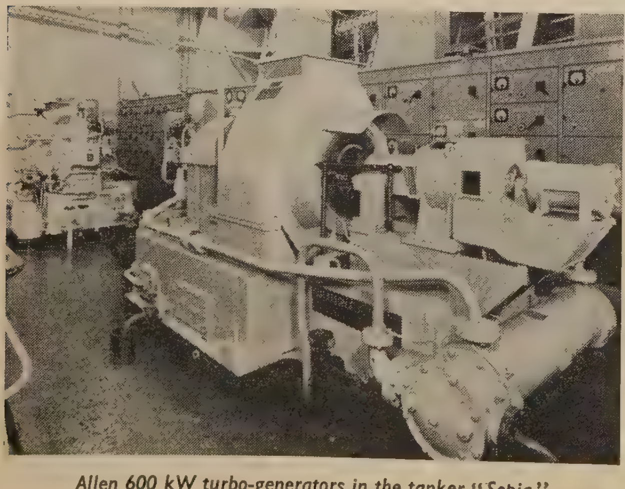
Specialist Engineering Contractors

For a number of years there has been informal co-operation between the Electrical Contractors' Association, the Association of Heating, Ventilating and Domestic Engineering Employers and the British Constructional Steelwork Association in matters of common interest relating to building and civil engineering projects. Now there has been formed by the three associations a Committee of Associations of Specialist Engineering Contractors to "provide a simple and quick means of consultation with specialist engineering contractors."

Membership is open to any trade association representing specialist engineering contractors engaged in building and civil engineering work. The Committee's address is 58, Victoria Street, London, S.W.1.

Generating Machinery for Shell Tanker

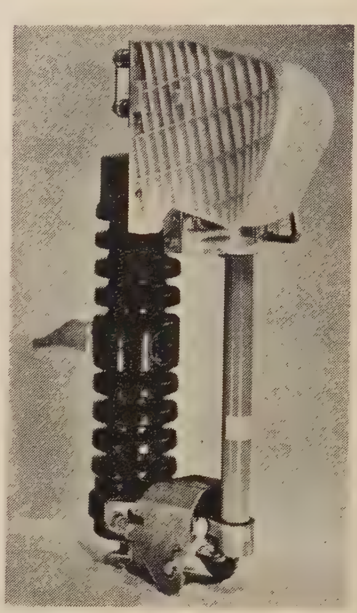
Electrical power for the new 65,000-ton tanker *Sepia* is supplied by two Allen 600 kW back-pressure turbo-generators. These operate with steam at 575 p.s.i.g. and 880°F, and with a back pressure of 15 p.s.i.g. The turbines run at 11,500 r.p.m. reduced through double-helical parallel-shaft gearing to the alternator speed of 1,800 r.p.m. The alternators are of the marine, ventilated, drip-proof, revolving-field, salient-pole type, are wound for a 440 V, three-phase, 60 c/s supply, and arranged for parallel operation with each other and with a 125 kW standby emergency diesel engine-driven alternator. The tanker was launched from the Birkenhead yard of Cammell Laird & Co. (Shipbuilders & Engineers), Ltd., to the order of Shell Tankers N.V. of Rotterdam.



Allen 600 kW turbo-generators in the tanker "Sepia"

OUTDOOR DISTRIBUTION SWITCH

A NEW load-break distribution cutout has been developed by the Westinghouse Electric Corporation of America. The unit uses Du Pont's "Delrin" acetal resin for the arc chute, and load-break operation is achieved by lowering the knife switch between the facing grids of the chute, away from the contact points. The normal arc is quickly extinguished (less than 0·1 sec) by a de-ionizing gas generated inside the chute from the resulting arc heat. It is claimed that the arc chute eliminates the need for replacing parts such as fuse links and gas bottles when breaking load, thus simplifying the operation.



Westinghouse LBU load-break distribution cutout showing the Du Pont's "Delrin" acetal resin arc chute

Extensive testing by Westinghouse has proved the performance of the arc chute for safe, reliable load-break operation. One unit underwent 200 load-break operations at 200 A, 15 kV with 0·7 power factor. Inspection of the chute showed almost no wear, only very slight discoloration, and no evidence of carbon tracking. Contacts on an arc chute on which a $\frac{1}{2}$in layer of ice had built up were opened easily with most of the ice falling away from the chute. There was no evidence of adhesion of the ice to "Delrin."

C.E.G.B. Payments to Farmers

The Central Electricity Generating Board has agreed to pay farmers higher rates of compensation for interference with agricultural operations in respect of its 400 kV transmission line towers which occupy more space than those hitherto in use.

Turners' London Showrooms

A new showroom for the Turners Asbestos Cement Co., Ltd., was officially opened recently at 34, Dover Street, London, W.1 (telephone: Hyde Park 5805). The showroom is intended for architects and consultants, building contractors and engineers as an information centre on asbestos cement products manufactured by the company. A full range of products is displayed, including "Sindanyo" electrical insulation materials.

Mr. H. A. Pursey, who was recently appointed London sales director, will, for the next few months, be making the showroom his headquarters in London. Mr. Pursey has been sales director since 1955 and was previously manager of the company's London office.

CORRUGATED ALUMINIUM SHEATHED CABLES FOR AUSTRALIA

The British Insulated Callender's Cables Group has received an order from the Electricity Trust of South Australia for the supply and installation of some 4,625 yd of 66 kV cables in the Adelaide area.

The cables under this contract are 0·75 sq in single-core oil-filled with corrugated seamless aluminium sheaths protected overall with an extruded p.v.c. oversheath which enables routine voltage tests to be applied to the sheaths to prove the integrity of the serving. The cables will be buried directly in the ground.

TRADE ANNOUNCEMENTS

New office accommodation to house the London staff of the **Ruston Group of Companies** has been acquired in Berkeley Square House, Mayfair, London, W.1. Mr. T. L. Kendall has been appointed executive director, with full control of the new office. Mr. J. G. Barber, who has been Ruston's London office manager for the past 12 years, has now been appointed export area manager, eastern bloc countries, and is succeeded as office manager by Mr. L. J. Lawrence.

The Special Products Division of **Thorn Electrical Industries, Ltd.,** have appointed Messrs. Hardman & Company, of Baillie Street, Rochdale, Lancs., as stockists and distributors for their electrical components and relays in North West England.

Crompton Parkinson Electrical, Ltd., of Brantford, Ontario, Canada, have taken over the sales of "Aeroflex" fuselinks designed to Canadian standards by **Parmiter, Hope & Sugden, Ltd.,** Manchester.

The **British Central Electrical Co., Ltd.,** announce the appointment of Mr. A. E. A. Wright, T.D., A.M.I.E.E., A.M.B.I.M., as agent for the sale of their speciality products in East Anglia.

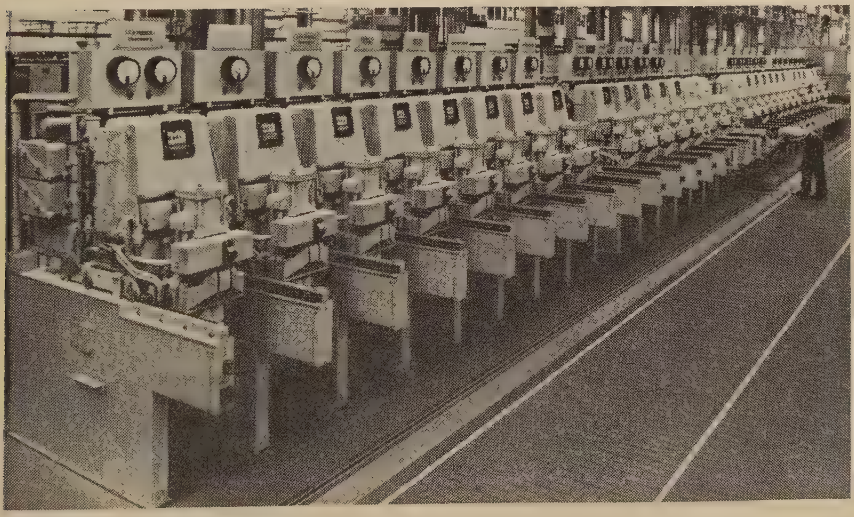
Polypenco, Ltd., have acquired new office premises at Gate House, Fretherne Road, Welwyn Garden City, Herts. All administrative departments of the company will move into the new address during this month; this will free additional space at the company's Broadwater Road and Tewin Road factories for production purposes. The telephone number (Welwyn Garden 25581) is unchanged.

The address of **Henry Wiggin & Co., Ltd.,** is now Holmer Road, Hereford.

The Aeroflex-Brilag range of cartridge fuse-links manufactured by **Parmiter, Hope & Sugden, Ltd.,** and designed originally to B.S. 88, 1952, Category 440 AC5, has now been fully tested to 460 DC4. The units have been tested to a breaking capacity of 46 kA at 440 V and are available with current ratings of 30, 60, 100, 200, 300 and 400 A.

Industrial electrolytic conductivity equipment for measuring solution concentration and water purity is now being manufactured by **Electronic Switchgear (London), Ltd.,** in their new factory at Wilbury Way, Hitchin, Herts.

Switchboard for Outfall Works



This 32-circuit switchboard, shown on final test at the Stafford works of the English Electric Co., Ltd., is for the new Southern Outfall Works of the London County Council, to be commissioned in 1962. The 6·6 kV 250 MVA double busbar board will control the power supply from the dual-fuel diesel-alternator sets to existing pumping stations in a ring main system. The board is solenoid operated with oil immersed off-load selector switches. Current ratings are 400/800/1,200 A

Bowthorpe Open Day

Last week an open day was held at the Crawley, Sussex, factory of Bowthorpe Holdings, Ltd., a group of companies which includes Hellermann, Ltd., Bowthorpe Electric Co., Ltd., the Bowthorpe Engineering Co., Ltd., and Line Equipment, Ltd., with factories also at Brighton, East Grinstead and Bridgend. Visitors saw the production of compression terminals, connectors, cable markers and sleeving for the electrical industry, in addition to a wide range of thermo-plastic injection mouldings up to 90 oz, flexible and semi-flexible thermo-plastic extrusions up to 4½in in diameter, and handles for the radio, television and other industries.

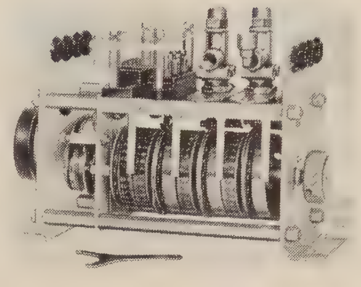
VEHICLE EQUIPMENT MANUFACTURE IN INDIA

A new company—Lucas-T.V.S. (Private), Ltd., has been formed as the result of an agreement between Joseph Lucas, Ltd., and the South Indian firm of T. V. Sundaran Iyengar & Sons. It will make vehicle electrical equipment for the Indian motor industry which is rapidly expanding. In the initial stages some components will be imported but it is expected that a new Madras factory will enable the whole of the production to be indigenous.

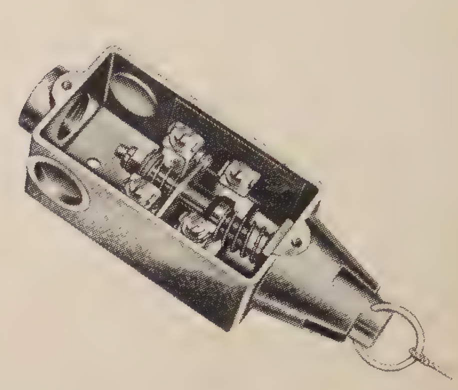
NEW ELECTRICAL EQUIPMENT

FUSIBLE LINK SWITCH

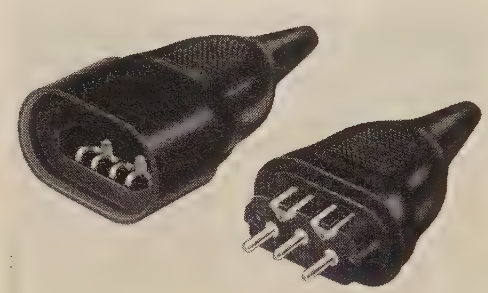
The type V/2A/P fusible link switch has been designed by CRAIG & DERRICOTT, LTD., Royal Works, Coleshill Street, Sutton Coldfield, for use with fusible link cables on furnaces and similar equipment and is arranged for operation by tension on the switch plunger. Normally the cable is attached to the switch plunger by a split ring and the tension provided by the cable ensures that the switch is held in such a position that a pair of contacts is made. When the fusible link melts the cable is released and the switch plunger returns to its rest position. Two sets of contacts, one normally closed and the other open, are provided, thus enabling an alarm contact to be incorporated when required.



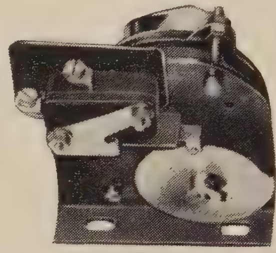
Rodene sequence timer



Craig & Derricott fusible link switch



Agro Electrical "Kalthoff" cable coupler



ElRemCo miniature synchronous single cam timer

MINIATURE SYNCHRONOUS TIMER

A simple and inexpensive timer with single changeover switch, the type OE1, introduced by the ELECTRICAL REMOTE CONTROL CO., LTD., Elremco Works, Harlow New Town, Essex, has a variety of available time cycles ranging from a few seconds up to 24 hr. Where the timer motor supply is the same as that of the switched load the timer can be wired to give single cycle and stop operation. Units can be supplied with synchronous motors operating from 110 and 200/250 V 50 or 60 c/s supplies. The switch ratings are 5 A at 250 V a.c. or 5 A at 24 V d.c.

CABLE COUPLERS

The distribution rights in the United Kingdom for the "Kalthoff" range of cable couplers has recently been acquired by the AGRO ELECTRICAL CO., LTD., National House, 60-66, Wardour Street, London, W.1. The couplers are constructed of "Neoprene," which is resistant to oils, chemicals and most solvents, and have a positive cord-grip inside the rubber sleeve. Tapered flanges and rims prevent the entry of dirt and moisture and ensure a firm connection of the plug and socket halves. Three types are available: two-pin and earth, rated at 15 A, 250 V a.c.; three-pin and earth, rated at 15 A, 440 V a.c.; and three-pin with separate earth and neutral contacts, also rated at 15 A, 440 V a.c. Wall sockets consisting of a ceramic base with a rubber shroud can be supplied for all three types.

SEQUENCE TIMER

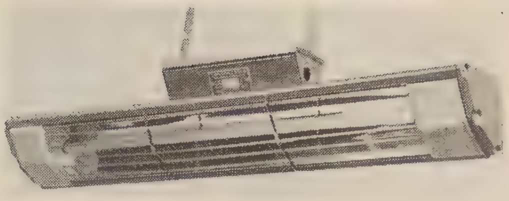
The range of sequence timers manufactured by the Rodene Electrical Co. has been extended by the addition of the "Magnacam," which can operate directly both electrical switches and air valves. These are individually replaceable and interchangeable. The valves are three-way units with $\frac{1}{8}$in bore suitable for use at pressures up to 80 p.s.i. The switches are single-pole double throw units rated at up to 15 A, and are complete with screw terminals.

Each switch is operated by two cams, one setting the "on" and the other the "off" positions. A drum calibrated in degrees is attached to each cam and a second gives the camshaft position. The minimum "on" time is that resulting from 4° of rotation, or 1° if two switches are used in series. Up to 24 pairs of cams can be fitted and camshaft speeds range from one revolution in 7 seconds to about one revolution per week. The camshaft action can be forward drive with automatic reset; forward drive only; or if two self-clutching motors are fitted, forward and backward drive. The timer is being distributed by D. ROBINSON & CO., LTD., 5/7, Church Road, Richmond, Surrey.

CURRENT LIMITING FUSE LINKS

The range of powder-filled current limiting fuses manufactured by LINE EQUIPMENT, LTD., 71a, Queen Victoria Street, London, E.C.4, has been extended to cover links for use in air, either indoors or outdoors, and for use in metalclad switchgear of both air and oil insulated types. Most fuses from 2·2 kV (5-300 A) to 66 kV (5-25 A) have been certified to B.S. 2692, and in all cases the tests have been taken under conditions more onerous than called for in the specification, as for instance the power factor for test duty 3 was below 0·1 p.f. instead of 0·6 p.f. as specified. In addi-

An industrial infra-red heater from the new "Thermodare" range



tion many tests at long melting times have been carried out corresponding to overloads, at low power factors. A number of these at test stations have been for periods from 20 to 70 sec, and in one instance in excess of 4 min, but in addition tests have been taken with a melting time of several hours.

DIGITAL COUNTER

Six in-line projection indicators, with automatic decimal point and caption indicator, are incorporated in the T.C.I.A. transistorised counter from ADVANCE COMPONENTS, LTD., Roebuck Road, Hainault, Essex. It is a laboratory grade instrument designed for the measurement of time, period and frequency and the counting of regular or random impulses from 0 to 10^6/sec. A thermally compensated internal crystal oscillator is used, enabling accurate measurements to commence immediately the instrument is switched on. There is accommodation for an external standard and self-checking facilities are incorporated to test the operation of all circuitry.

A sensitivity control enables discrimination to be made against spurious signals of lower amplitude.

Advance Components type T.C.I.A. counter

Signals down to 100 mV r.m.s. and up to 250 V r.m.s. at frequencies from 10 c/s to at least 1 Mc/s may be measured. The v.l.f. input enables measurements to be made below 10 c/s down to virtual d.c. Pulse width measurement can also be made. Output timing pulses, variable in decade steps from 10^{-1} to 10^6 pulses/sec, are an additional facility and there is provision for an external recorder.

Time measurement can be made from 3 μsec to 2,777 hr, and period measurement with durations of from 1 to 10^5 periods of input waveform up to 50 kc/s. The display time is from 1 to 5 sec, or "hold," and repetition of the count can be by manual, automatic or external control. The counter is suitable for operation from an 85 V to 140 V or 190 V to 250 V, 40 to 100 c/s single-phase supply, the consumption being 30 VA. The price is £395 net in the United Kingdom.

LIQUID LEVEL CONTROLLER

The "AutoDip" equipment announced by LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LTD., Rugeley, Staffs., is designed to provide single or two point control of the level of liquids in containers. The units are suited to applications where the container depth necessitates the use of long probes. No restriction is placed on the length of the probe which may be constructed of any electrically conductive material appropriate to the liquid involved. The apparatus operates on the change in electrical resistance which occurs as the liquid contacts the probe. This change in condition is detected and used to operate an internal relay. The unit will operate over a resistance range from zero to 500,000 Ω, making the equipment suitable for use in most electrically conductive liquids.

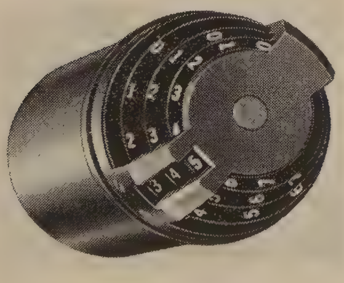
COAXIAL SWITCH UNITS

Two coaxial switch units measuring only 2½in in diameter and providing from 3 to 30 discrete circuits are now available from WAYNE KERR LABORATORIES, LTD., 44, Coombe Road, New Malden, Surrey. These sub-miniature switches, known as CSU-1 and CSU-1A, are designed for the remote electrical control of decade or binary information. Within each unit are three or four switches with up to twelve positions, all of which are controlled by the concentric dial arrangement. Both units have in-line readout and gear-driven switch assemblies and both are available for servo ring or flange mounting. Connections to these switches are made by a sub-miniature connector at the rear.

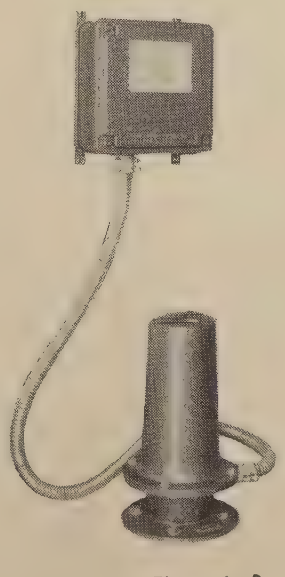
INFRA-RED HEATERS

An improved version of the "Thermodare" infra-red industrial heater has been announced by the manufacturers, THERMODARE (GREAT BRITAIN), 94/98, Petty France, London, S.W.1. It now has a polychromatic bronze hammered finish and the reflector has been designed for easy removal for cleaning or replacement. The element assembly and guard is hinged to swing forward and upwards to give access to the element connections and reflector. Suspension arms are fitted to the heater as standard and provision is made for alternative conduit suspension.

Details and prices of the new models are as follows:—Model ICR.800 (800 W) £6 12s 6d; ICR.1200 (1,200 W)



Wayne Kerr coaxial switch unit



Lancashire Dynamo Electronic Products liquid level controller

£7 10s; ICR.2000 (2 kW) £9 15s. The overall length of these three heaters is 33in. Models ICR.3000 (3 kW) £14 18s 6d and ICR.4000 (4 kW) £16 14s. The overall length of these last two models is 55in. Those below 800 W have now been discontinued as the company feels that the domestic range provides an effective substitute.

WINDOW DEMISTER

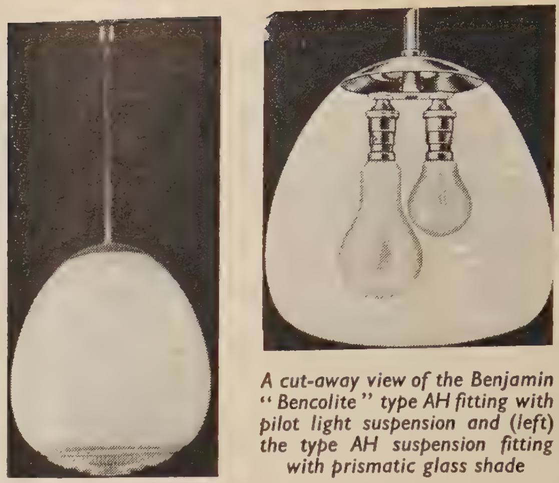
The latest addition to the "Spiromic" electric heating units manufactured by A. & R. Electric Co., Ltd., 1, Bruce Avenue, Shepperton, Middx., are window demisting units. They are made in 2ft lengths, each with a loading of 100 W and with the use of extension pieces they can be installed in continuous lengths of up to 30ft. Each of the wiring terminals is colour coded. The heating element is similar to that used in the company's skirting heating units—a nickel-chrome element sealed into a toughened silica-glass tube encased in a metal grille. The finish is bronze stoved enamel.

RECHARGEABLE CELL

A rechargeable torch battery is to be marketed by Electronics & Automation (London), Ltd., Maxwell House, Arundel Street, London, W.C.2. The battery, the size of two U-2 standard cells, is charged by removing a cap, which switches in the internal rectifier, and then plugging the two 5 A standard pins revealed into a mains socket. The battery is guaranteed by the makers for one year. The storage section is hermetically sealed.

The battery is constructed for recharging from 110 V to 250 V supplies. The charging time at 250 V is 14 hr and 20 hr at 110 V. Batteries are available, with voltages of 2·5, 3·5, 5 and 6 V, of both light duty and heavy duty types, the former for operating with standard torch bulbs of 0·15 A consumption. Prices range from 29s 6d for a 2·5 V light duty unit to 59s 6d for a 6 V heavy duty battery.

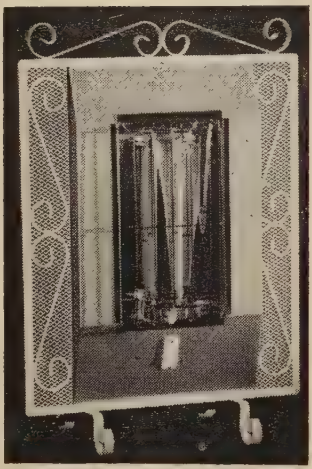
Electronics & Automation rechargeable battery



A cut-away view of the Benjamin "Bencolite" type AH fitting with pilot light suspension and (left) the type AH suspension fitting with prismatic glass shade

SCREEN FIRE

The "Laredo" wrought iron screen fire now being marketed by David C. Lesser & Co., Ltd., 510a, Coventry Road, Birmingham, 10, is designed to serve as a normal firescreen as well as an electric heating unit. It is fitted with two 1 kW vertical mounted heating elements. The back of the fire fits into the grate, leaving the wrought iron screen to fit flush against the tiled surround. It is finished in white/gold, black/white or burgundy/white and the price, including purchase tax, is £9 5s 9d.



Lesser "Laredo" wrought iron screen fire

LIGHTING FITTINGS

The "Bencolite" range of opal glass lighting fittings, manufactured by the Benjamin Electric, Ltd., Brantwood Road, Tottenham, London, N.17, has been increased by the addition of new models including ceiling and waterproof types, acorn, cone and pumpkin shapes, spheres, etc. The new fittings have been introduced in anticipation of the Offices Act.

For every pendant type fitting there is an equivalent ceiling fixing type bearing the same code designation. The ceiling fittings use the "Manx" gallery supporting a globe on three internal arms. The gallery is suitable for conduit box mounting and conduit suspension.

A night light suspension is available as an alternative on most sizes of the pendant type fittings. This combines a small amount of upward light, for low level illumination, with the general lighting features of a normal fitting. There is also a pilot light suspension (except GH fittings) which embodies within the main globe an extra b.c. lampholder for a low wattage pilot lamp.

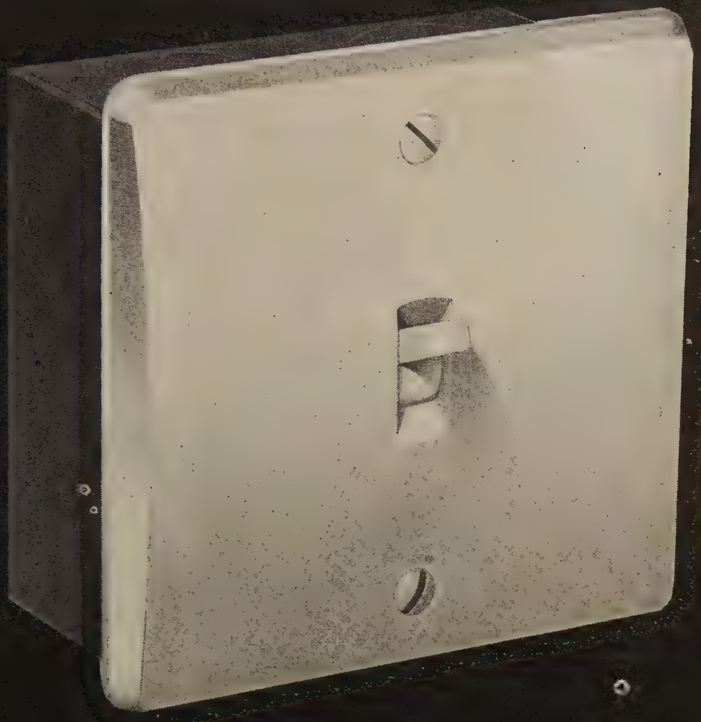
For use where considerable moisture is present the company offers the WS fittings in which a rubber gasket seals the joint between the globe and the gallery. The "Anolier" indirect lighting unit will be added to the new range for office lighting.

IMPROVED LAMPHOLDER

The new type TM/401 b.c. lampholder now being manufactured by George Turnock, Ltd., Tunion Works, Navigation Street, Walsall, is claimed to be an improvement on the company's original model. It has a porcelain interior and the flex is self-anchoring, making the lampholder easy to wire. A common fault with lampholders is that the shade carrier ring becomes jammed, due to the expansion of the bakelite through heat. To overcome this the threads of this model are chased and the manufacturers claim that the ring can be easily removed when replacing shades, etc. The price, per dozen, is 16s 11d.

the switch that is silent...

'MUTAC CLIPPER'



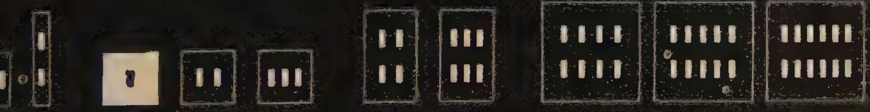
G.E.C. Installation Equipment Group have a *new approach* to switch design which serves to take the clicking out of switching.

If you listen hard enough you *may* just hear the discreet whisper of a 'Mutac Clipper'.

Furthermore, the *new approach* makes 'Mutac Clipper' switches unrivalled for ease and speed of assembly . . . ensures that these precision-made, electronically-tested switches give a guaranteed long-life performance.

G.E.C.'s *new approach* enables you to put one, two or three 'Mutac Clipper' switches in a standard BS1299 box. There's a choice of 44 different switch plates—in moulded plastic or metal—and 11 interchangeable units fit into just three different sized boxes:

5 amp 1 way S.P.
15 amp 1 way S.P.
5 amp 1 way D.P.
5 amp 2 way S.P.
5 amp 2 way & off
5 amp intermediate
5 amp 1 way secret
5 amp 2 way secret
Bell Push
Neon Indicator
Blanking Unit



'Mutac Clipper' switches cost no more than ordinary switches to buy and far less to install—that's a result of G.E.C.'s *new approach*. Complete interchangeability of 'Mutac Clipper' enables you to standardise right through a job.

that's the New Approach of G.E.C.

INSTALLATION EQUIPMENT GROUP

IMMEDIATE DELIVERY of all 'Mutac Clipper' switches from wholesalers throughout the country. If you would like more detailed information, ask your wholesaler for 'Mutac Clipper' literature.

complete battery schemes for SUBSTATIONS

Tudor Battery Equipment for—

E.H.T. SWITCH OPERATING

EMERGENCY DUTIES • INDICATION

PROTECTION • ALARMS

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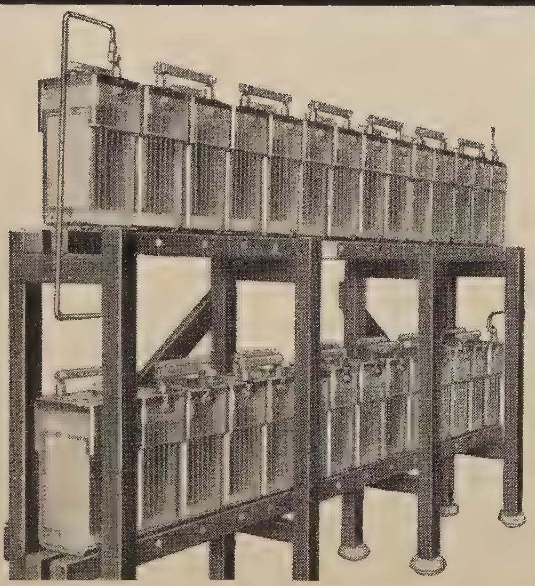
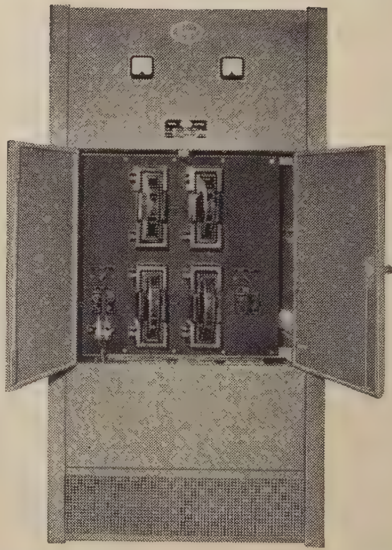
The D.P. Battery Company Ltd. specialise in the design and supply of Tudor Batteries, charging equipment and switchboards for substations. Highly experienced engineering staff provide a complete service, from initial planning to final installation.



◄ Part of a 110-V battery of latest Tudor High Performance Cells in a Midlands Electricity Board substation at Fenton, Staffs.

► This combined automatic charger/fuseboard is part of the Tudor installation. Photos: Courtesy The Midlands Electricity Board.



The latest Tudor High Performance Cell

provides a saving in space up to 50% when compared with BS sealed cells, while retaining the advantages of long life, reliability and negligible maintenance.

Tudor BATTERIES

For further details of Tudor battery equipment write to:

THE D.P. BATTERY CO. LTD. MAKERS OF KATHANODE AND TUDOR BATTERIES BAKEWELL DERBYSHIRE TEL BAKEWELL 581/5

TGA T177

Electric Shock Treatment*

METHODS OF ARTIFICIAL RESPIRATION

By Dr. HERALD J. GILBERT, M.B., B.S.

RECENT advances in the field of artificial respiration have been considerable. This statement sounds reasonable and accurate, but is it ? Is the mouth-to-mouth method of artificial respiration, which the statement brings to mind, really recent, i.e. new, and is it really an advance ? New? No. Reference is made to it in the Bible and doctors have been using it for years on a new born asphyxiated baby.

Advance ? Possibly, but it has some serious drawbacks and these must be considered fully before accepting or refuting this method of artificial respiration as the ideal. First, the actual mouth-to-mouth contact is looked upon as " dirty," " not nice," " unpleasant," " abhorrent " or even immoral by many people. I am not being flippant. This is expressed as a serious criticism in many quarters and there may be a large number of people who would not be prepared to use this method because of this.

Secondly, there is such close contact that germs of disease may quite easily spread from operator to casualty and vice versa.

Thirdly, the close contact again could possibly permit the asphyxiating substance, especially if it be gas or poison, to pass in sufficient quantity to the operator to produce two casualties instead of one.

Fourthly, it is difficult to know how much pressure to use when inflating the lungs of the casualty by blowing in from your own lungs. It is reasonably easy to use too much pressure and thereby over-blow the casualty's lungs producing a tear or haemorrhage in the lungs and these, of course, are very serious complications.

Fifthly, in drowning cases no amount of mouth-to-mouth artificial respiration will help if the water is not removed from the lungs first as oxygen will not pass through the water barrier.

Finally, a criticism which applies particularly to gassing cases. The red cells of the blood which carry the oxygen to the tissues prefer carbon monoxide to oxygen and will give up their oxygen and take on carbon monoxide on the slightest pretext. This is very unfortunate for us and the only way you will persuade the cells to reverse the process is to give them no choice but bathe them in as near to 100 per cent oxygen as you can get.

The exhaled air from our lungs contains only about 10 per cent oxygen and is, therefore, unlikely to replenish the red cells with oxygen except over a very considerable length of time. By then damage to the brain cells could be extensive.

It follows from these criticisms that mouth-to-mouth artificial respiration is still not the ideal and in my opinion Holger Neilsen artificial respiration, especially plus the use of a resuscitator of 100 per cent oxygen, is still by far and away the best method available.

I will go so far as to say that I believe mouth to mouth has a place in the field of artificial respiration but a limited one. I visualise the case of a casualty buried under debris or fallen stone or masonry or wedged in a confined space such as a pipe or trench. In such cases mouth to mouth would be most valuable in keeping the casualty alive and breathing until released, when the Holger Neilsen artificial respiration could be performed with or without a resuscitator. I recommend it strongly in such cirumstances.

Our friends across the Atlantic in America have not accepted Holger Neilsen artificial respiration at all and are 100 per cent for mouth to mouth. In an attempt to popularise this method and to get over some of the criticisms they have produced a plastic airway to be inserted into the throat of the casualty and down which air is blown from the operator's lungs into those of the casualty.

Certainly it got over the criticism of direct mouth-to-mouth contact but the other drawbacks remained and one or two were added such as the risk of the long airway touching the top of the windpipe in a not deeply unconscious patient and so producing spasm and asphyxia instead of curing it, and the difficulty of arranging practice in its use. I imagine the number of people volunteering to have an airway pushed down the throat a number of times would be extremely limited.

Since the appearance of the first airway many more have arrived on the scene both here and in the U.S.A., but I do not propose to go into detail on all of them. Suffice it to say that new ones are appearing every week and many of the drawbacks to mouth to mouth are being overcome. It may be that an ideal airway will eventually be produced, but I feel sure that many more years of experiment and trial and error will have to pass before this happy state of affairs is reached.

It seems to me that although some of the most recent of the airways can be of value they have little advantage over the direct mouth-to-mouth method of artificial respiration, in this at least no equipment need be carried and this is a considerable advantage in first aid.

In spite of " recent advances " I still believe that Holger Neilsen artificial respiration reigns supreme and is the method of choice in all cases of asphyxia.

[Editorial comment is made on page 732.]

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* Reproduced from *The Nor'-Easter*, the staff magazine of the North Eastern Electricity Board and the C.E.G.B. North Eastern Division.

EURATOM PUBLICATION

A 32-page illustrated brochure on Euratom, the European Atomic Energy Community, is now available (free of charge) from the London office of the information service of the European Communities.

The brochure deals with the origins, aims and achievements of the Community since it was set up in January, 1958, and the prospects for nuclear power within the Community. An extensive section deals with the research activities of Euratom, including its participation in the Dragon project.

CIRCUIT PROTECTION AND CONTROL

NEARLY 1,500 consultants, contractors, architects, engineers and wholesalers attended a lecture on modern methods of circuit protection and control given in London by Mr. J. A. Robbins, of J. A. Crabtree & Co., Ltd., on Tuesday, Wednesday and Thursday last week. He began by quoting the increase in fires of electrical origin to emphasise the importance of adequate protection and then compared the performance of fuses and miniature circuit-breakers. The ideal device for overload and short-circuit protection must be capable of carrying normal currents without overheating and ageing. It should also be capable of detecting small sustained overloads, but tolerating transient overloads. A rewirable fuse would normally carry 200 per cent of rated current for some time before operating, although a h.r.c. fuse gave closer protection since it operated on a sustained 160 per cent overload. An m.c.b. could be arranged to operate on a continuous 25 per cent overload, and have a time delay under moderate overloads sufficient to tolerate normal transient surges, such as motor starting currents.

Tripping Mechanism

Mr. Robbins went on to compare the three main types of tripping mechanism used in m.c.b.'s to produce the desired combination of time-delay and instantaneous tripping. In the first method, line current was used to heat a bi-metal element, and the consequent movement of this strip triggered the tripping mechanism. The time taken to heat the bi-metal produced the inverse time-delay characteristic. This type of unit was usually set to trip on about a 25-30 per cent sustained overload at normal ambient temperatures, although lower current ratings might be set to trip at about a 50 per cent sustained overload.

The second form of mechanism, known as the "assisted bi-metal" mechanism, also relied on the action of a bi-metal element for time-delay tripping under sustained overload conditions. For short-circuit operation, the element was mounted in close proximity to a strip of ferrous material. The magnetic field associated with the current flowing in the bi-metal interlinked with the ferrous material, producing a sideways pull on the bi-metal. By arranging this to coincide with the normal direction of deflection of the bi-metal, the action of the bi-metal was accelerated under short-circuit conditions.

The final method utilised a hermetically-sealed dashpot time-delay mechanism. An iron slug was held at one end of a closely-fitting tube by a spring, the tube being filled with a silicone fluid possessing a reasonably flat temperature-viscosity characteristic. Under moderate overload conditions, the magnetic field produced by a coil surrounding the tube overcame the restraining force of the spring, and pulled the slug inwards. Its speed was governed by the degree of overload and the viscosity of the silicone fluid. When the slug reached the top of the tube it completed a magnetic circuit, tripping the breaker. This dashpot arrangement gave an inverse time-delay characteristic under overload conditions. Under heavy overload or short-circuit conditions, the iron circuit surrounding the tube was good enough to attract the trip lever without the slug moving. This form of construction gave time-delay tripping up to about six to ten times full load, and instantaneous tripping above that limit. Wide variations in ambient temperature did not affect either the continuously rated current or the value of the minimum tripping current at which the unit will operate.

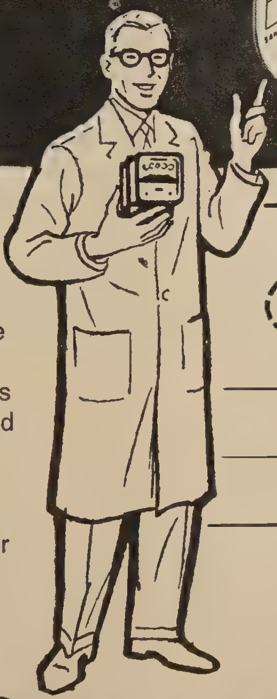
After this, Mr. Robbins considered the effect of circuit conditions. The actual short-circuit current that a protective device might have to clear was normally much less than the theoretical maximum due to the current-limiting effects of the cabling from the protective device to the fault, the impedance of the fault and the impedance of the protective device itself. The severity of operation was also determined by the power factor of the fault current. The value of the prospective short-circuit power factor was determined solely by circuit conditions up to the fault point. The power factor under actual fault conditions was normally much higher than the prospective value, reducing the severity of operation. Low power factors normally indicated considerable reactance and arc energy under short-circuit conditions, but actual power factors were usually well in excess of 0·9.

When considering prospective fault-current conditions on feeders and sub-circuits, the impedance of the h.v. network feeding the transformers might be ignored. The transformer alone might have a considerable limiting effect. For example, the maximum short-circuit fault current likely to be obtained from a 250 kVA transformer—even with a direct interphase fault on the transformer busbars—was only about 6,500 A. The current-limiting effect of cables was usually considerable. The resistance of a 10 yd run of 3/·029in cable alone, even when tapped directly off the busbars of a 1,000 kVA transformer, was quite sufficient to limit the single-phase fault current to about 1,000 A. Actual short-circuit faults on sub-circuits, either between lines or from line to neutral, would rarely exceed about 1,000 A and would virtually never exceed 1,500 A. If the fault was an earth fault, the current was likely to be even more severely limited, perhaps only of the order of milliamps.

Breaking Capacity Tests

In dealing with tests to certify breaking capacity, Mr. Robbins said that with certain forms of construction, the breaking capacity of the lower current ratings might be substantially less than that of higher current ratings in the same frame size. Alternatively, with other forms of construction the high internal impedance of the lower current ratings would automatically limit the actual test current to a value well within the capacity of the breaker. He therefore thought that it was necessary to test at least the lowest and highest standard current ratings in the manufacturing range of circuit-breakers to establish the breaking capacity of the range. It was not sufficient just to demonstrate the ability of the circuit-breaker to clear a certain prospective fault current.

Finally, Mr. Robbins described the construction, operation and applications of miniature circuit-breakers, referring particularly to those on view in a supporting exhibition which had been organised by J. A. Crabtree & Co., Ltd.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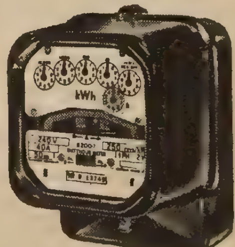

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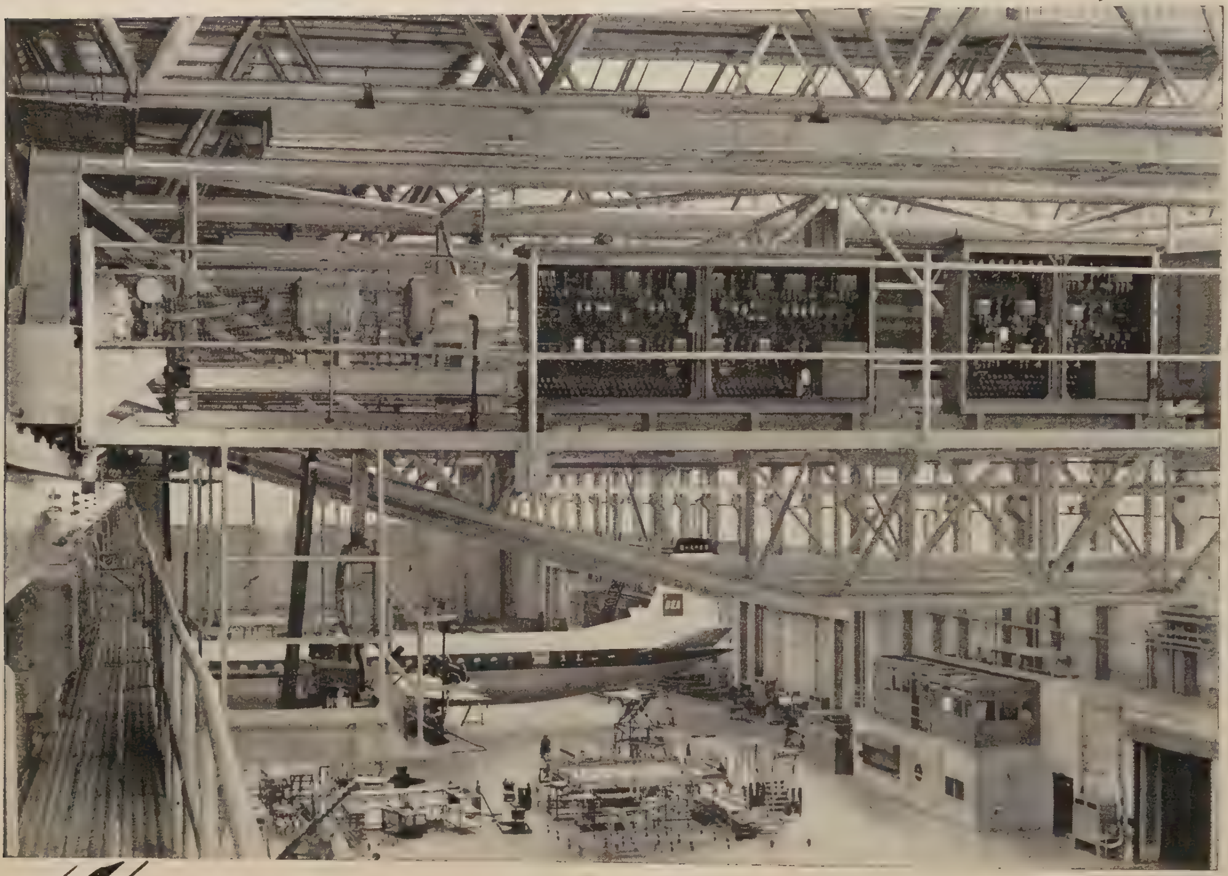

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NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the “Electrical Review” clearing house, Room 243a, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged, but, in some cases, not yet announced

MONDAY, 13th NOVEMBER

Birmingham.—College of Advanced Technology, Gosta Green, 6 p.m. I.E.E. South Midland Supply and Utilisation Group. “Electricity in the Manufacture of Hydrogen-Peroxide,” by B. E. A. Vigers and R. O. Fletcher.

Bournemouth.—South Western Hotel, Holdenhurst Road, 8 p.m. A.S.E.E. Bournemouth and District Branch. “Electrics in Aircraft,” by R. Renshawe.

Bristol.—University Engineering Laboratories, 6 p.m. I.E.E. Western Centre. “Technical and Economic Aspects of the Supply of Reactive Power in England and Wales,” by W. Casson and H. J. Sheppard.

Glasgow.—Royal College of Science and Technology, 6 p.m. I.E.E. Scottish Electronics and Measurement Group. “Numerical Control of Machine Tools,” by D. F. Walker.

Great Malvern.—Winter Gardens, 7.30 p.m. I.E.E. South Midland Centre. Malvern and District meeting. “Lighting for Monochrome TV Productions,” by P. Catlett, and “Colour TV Production Problems,” by I. Atkins.

Liverpool.—Royal Institution, 6.30 p.m. I.E.E. Mersey and North Wales Centre. “Some Notes on the Electrical Requirements of General Cargo Docks,” by E. R. Radway.

London.—Savoy Place, W.C.2, 6.45 p.m. I.E.E. London Graduate and Student Section. “The Work of the B.B.C., with Particular Reference to Transmitters,” by R. W. Leslie.

Manchester.—University, 6.45 p.m. Society of Instrument Technology, Manchester Section. “The Role of the Physicist in Plant Instrumentation,” by Dr. L. J. R. Postle. Joint meeting with the Institute of Physics and the Physical Society.

Newcastle-upon-Tyne. — Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North Eastern Centre. “Electronic Analogue Computer Simulation of Multi-Machine Power System Networks,” by Dr. A. S. Aldred, and “Analysis of Overall Stability of Multi-Machine Power Systems,” by J. G. Miles.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.S. Sheffield Centre. “The New I.E.S. Code,” by H. E. Bellchambers.

Stoke-on-Trent.—North Stafford Hotel, 6 p.m. for 6.30 p.m. I.E.S. Stoke-on-Trent Group. “Lighting Journey down the Rhine,” by E. J. Smith.

Stone.—Duncan Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. “Data Transmission,” by R. H. Franklin and J. Rhodes.

Wembley.—Century Hotel, 8.15 p.m. A.S.E.E. North West London Branch. “Relays and Control Circuits,” by Dr. W. L. Stern.

Edinburgh.—Carlton Hotel, 7 p.m. I.E.E. Scottish Electronics and Measurement Group. “Numerical Control of Machine Tools,” by D. F. Walker

Farnborough.—Queens Hotel, 8 p.m. A.S.E.E. Aldershot and Districts Branch. “Instrumentation.”

Glasgow.—Kenilworth Hotel, 5, Queen Street, 8 p.m. A.S.E.E. Glasgow Branch. “Electrical Maintenance.”

Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, 6 p.m. I.E.S. Glasgow Centre. “The Mining Electrical Engineer Looks at Lighting,” by J. Rae. Joint meeting with the A.M.E.M.E.

Leeds.—College of Technology, Calverley Street, 6.30 p.m. I.E.E. North Midland Education Discussion Circle. “The Integration of Industrial and Academic Training,” by J. S. Hudson.

Leicester.—Westcotes Constitutional Club, 124, Wilberforce Road, 7.30 p.m. A.S.E.E. Leicester Branch. “Electro-Magnetic Techniques in Flaw Detection,” by L. H. Mansell.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. “Tracking in Insulation,” by N. Parkman.

Connaught Rooms, W.C.2, 12.30 for 1 p.m. Electrical Industries Club Luncheon. Talk on India by Sir Frederick James.

Magnet House, Kingsway, W.C.2, 6.15 p.m. A.S.E.E. “The Contribution of Nuclear Reactors to Engineering Progress,” by Dr. K. J. Wootton.

Livery Hall, Guildhall, 7 for 7.30 p.m. The Lightmongers. Annual dinner.

Federation of British Industries, Tothill Street, S.W.1, 5.30 p.m. I.E.S. “Changes in the Dimensions of Incandescent Lamps,” by A. G. Penny; “A Standard Heat Test Lamp for the Temperature Testing of Lighting Fittings,” by J. N. Bowtell and J. R. Coaton; “Temperatures in Lighting Equipment with Incandescent Lamps,” by J. Keen and H. F. Stephenson.

Manchester.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North Western Centre. “Progress in Oil-Filled Cables and their Accessories,” by Dr. A. N. Arman and G. R. Bishop; “The Influence of Ageing on the Characteristics of Oil-Filled Cable Dielectrics,” by Dr. P. Gazzana Priaroggia, Dr. G. L. Palandri and Dr. U. A. Pelegatti.

Oxford.—Board Room, Employment Exchange, St. Aldates, 7.30 p.m. A.S.E.E. Oxford and Districts Branch. “The Uses and Installation of Mineral Insulated Covered Cables.”

Plymouth.—Plymouth “B” Generating Station, Prince Rock, 3 p.m. I.E.E. South Western Sub-Centre. “The Organisation of Industrial Electrical Maintenance,” by S. R. Phelps.

Southampton.—University, 6 p.m. I.E.E. Southern Electronics and Control Group. “High-Speed Ferrite Core Stores,” by P. Cooke.

Treforest.—Glamorgan College of Technology, 7 p.m. I.E.E. Cardiff Graduate and Student Section. “Television Outside Broadcasts as Seen by a Junior Technical Assistant,” by E. J. R. Hartley.

York.—Royal Station Hotel, 7.30 p.m. A.S.E.E. York Branch. “Pumps and Pumping,” by J. H. Trougher.

MONDAY, 13th to SATURDAY, 18th NOVEMBER

London.—Earls Court. Factory Equipment, Engineering Materials and Design Exhibition.

TUESDAY, 14th NOVEMBER

Belfast.—Lecture Theatre LG25, David Keir Building, Queen's University, Stranmillis Road, 6.30 p.m. I.E.E. Northern Ireland Centre. “The Potentialities of Artificial Earth Satellites for Radiocommunication,” by W. J. Bray.

Bristol.—Grand Hotel, 8 p.m. A.S.E.E. Bristol and West of England Branch, Graduate Section. “Special Pyrotenax Cables,” by R. W. Sutherland.

Broadstairs.—Clarendon Hotel, 8 p.m. A.S.E.E. East Kent Branch. “Some Aspects of Consulting Engineering,” by A. Ellis.

Chester.—Blossoms Hotel, 7.45 p.m. A.S.E.E. Chester and District Branch. “Some Aspects of Electricity Distribution in Rural Areas,” by H. V. Hayes.

Ipswich.—Electric House, 6.30 p.m. I.E.E. East Anglian Sub-Centre. Third Hunter Memorial Lecture. “The Application of Electronics to the Electricity Supply Industry,” by Dr. J. S. Forrest.

London.—Café Royal, Regent Street, W.1, 6.30 for 7 p.m. Dynamicables. Dinner.

Nottingham.—Victoria Station Hotel, 6.45 for 7.30 p.m. I.E.E. East Midland Centre. Annual dinner.

Portsmouth.—C.E.G.B. Offices, High Street, 6.30 p.m. I.E.E. Southern Centre. “A General Theory of Depreciation of Engineering Plant,” by D. Rudd.

Rugby.—Masonic Hall, 7.30 p.m. I.E.E. Rugby Sub-Centre. Annual dinner.

Sheffield.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. “The Engineering Aspects of Plasma Physics,” by D. L. Smart.

Thetford.—Red Lion Hotel, 7.30 p.m. A.S.E.E. East Anglia (Thetford) Centre. “Electric Motor Control Gear,” by R. F. Mathieson.

Wolverhampton.—Chamber of Commerce, District Bank Chambers, Lichfield Street, 7.45 p.m. A.S.E.E. Wolverhampton and District Branch. “Transportation of Heavy Loads,” by S. Bowskill.

WEDNESDAY, 15th NOVEMBER

Bristol.—College of Science and Technology, Ashley Down, 7 p.m. British Institution of Radio Engineers, South Western Section. “Introduction to Analogue Computers,” by P. G. Davies.

Department of Physics, University of Bristol, The Royal Fort, 7.30 p.m. Society of Instrument Technology, Bristol Section. “Instrumentation at Low Temperatures,” by Dr. R. G. Chambers.

WEDNESDAY, 15th to WEDNESDAY, 29th NOVEMBER

London.—Olympia. Building Exhibition.

THURSDAY, 16th NOVEMBER

Birmingham.—Farcroft Hotel, Rookery Road, 8 p.m. A.S.E.E. Birmingham Branch. Buffet-dance.

Blackburn.—Castle Hotel, 7.30 p.m. Institution of Plant Engineers, Blackburn Branch. “The Free Piston Engine,” by W. Lowe.

Carlisle.—Technical College, Victoria Place, 7 p.m. I.E.E. North Eastern Graduate and Student Section. “Radiation, its Detection, Measurement and Uses,” by B. Nugent.

Chelmsford.—Social Hall, Hoffmann's, Ltd., 7.30 p.m. Chelmsford Engineering Society. “Development of Eurovision,” by M. J. L. Pulling.

Dublin.—Physical Laboratory, Trinity College, 6 p.m. I.E.E. Irish Branch. “Performance of E.S.B. Transmission System after 35 years,” by P. J. Tierney.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilisation Section. “The Design and Performance of High and Low Voltage Terminal Boxes,” by K. K. Schwarz.

FRIDAY, 17th NOVEMBER

Aberdeen.—Robert Gordon's Technical College, 7.30 p.m. Institute of Marine Engineers, Scottish Section. Joint meeting with the Aberdeen Mechanical Society. “Elementary Nuclear Engineering,” by H. F. Close.

Bristol.—Grand Hotel. A.S.E.E. Bristol and West of England Branch. Annual dinner and dance.

Leeds.—Queen's Hotel, 7 for 7.30 p.m. I.E.E. North Midland Centre. Annual dinner.

London.—Feathers Hotel, Broadway, S.W.1, 6 for 6.30 p.m. Electrical Trades Commercial Travellers' Association. Annual general meeting.

Newcastle-upon-Tyne.—Grey Hall, King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. “The Transient Performance of the Synchronous Generator,” by M. W. Kennedy.

Wembley.—Century Hotel. A.S.E.E. North West London Branch. Annual dinner and dance.

SATURDAY, 18th NOVEMBER

Manchester.—Bavarian Suite, Belle Vue. A.S.E.E. Manchester Branch. Ladies' evening.

Financial Section

STOCKS and SHARES

THE further small reduction in Bank Rate helped to sustain the recovery movement in the gilt-edged market of the Stock Exchange. Its influence upon industrial share prices was, however, neutralised by the appearance of more evidence, in the half yearly progress reports of prominent firms, about the effect of contracting profit margins upon current company earnings. In this respect the statement from Courtaulds carried most weight as a damper upon any significant revival of interest in industrials.

Electrical Shares

Shares of the major electrical groups responded to comment upon the extent to which trading difficulties have been discounted by this year's further heavy fall in prices. G.E.C. at 26s 3d and English Electric at 28s 6d gained a shilling or so during the week, and A.E.I. improved to 30s 9d. Crompton Parkinson went further ahead to 12s 9d under the influence of the good results reported earlier. Plessey shares issued to former members of Ericsson and Automatic Telephone moved up well to 42s, and the new convertible loan stock was in good demand at around 100½. B.I.C.C. at 57s were firmly supported in advance of the half-yearly statement, and there were material gains elsewhere in Decca, Ultra, Metal Industries and Westinghouse. Dealings were expected to start yesterday (Thursday) in Racal Electronics.

T. I. Results

A preliminary statement on the results of Tube Investments for the year ended in July refuted the pessimistic forecasts which had been partly responsible for the fall in the price of the £1 shares from this year's peak of 85s 6d to last month's low point of 54s. Having recovered to a little above 60s on the eve of the announcement, the shares were raised immediately to 67s 6d, reacting later to 64s on the report of a £27·1 million profit for the year, giving threefold cover for the ordinary dividend of 14 per cent. This produces a yield of nearly 4½ per cent on the shares. Comparison with last year's figures is confused by the introduction of new acquisitions, but the result was interpreted as particularly satisfactory when considered in relation to the severe falls in the profits of the British Aluminium and Raleigh Industries subsidiaries.

Aberdare Issues

Since the publication of details of new issues to be made towards the end of this month, Aberdare Holdings 5s shares have risen to 17s 3d and hold now the very uncommon distinction of standing near their best price of the year. Shareholders are to be offered simultaneously a one-for-three scrip

Price Changes in

Company or Board	Nom. Value	Middle price 6th Nov.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1961 High-est	1961 Low-est
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	75½		3	3	3 19 6	75½	70½
Brit. Elec. 1974/77	100	70	+½	3	3	4 5 9	70½	64½
Brit. Elec. 1976/79	100	71	+½	3½	3½	4 18 6	73½	67
Brit. Elec. 1974/79	100	80	+1	4¼	4¼	5 6 3	82	75
Brit. Elec. 1967/69	100	92	+½	4½	4½	4 17 9	92	86
Overseas Electric Supply								
Calcutta Elec.	£1	21/3		7†	7½†	11 11 0	22/3	20/6
East African Power	£1	13/-		8	10	15 7 9	15/-	13/-
Nigerian Elec.	£1	19/-		10	14	14 14 9	19/9	15/6
Perak Hydro-Elec.	£1	20/6		15	15	14 12 9	23/6	17/6
Electrical Shares								
Aberdare Holdings	5/-	17/3	+3d	17½	17½	—	17/3	14/3
Aerialite	1/-	4/3		54	40	9 8 3	8/-	4/3
Allen, W. H.	£1	25/-	−1/-	14	10*	8 0 0	42/6	25/-
Allied Insulators	5/-	8/3	+3d	20	10*	6 1 3	10/-	8/-
Alwyn Holdings	5/-	20/6	−6d	12½	15‡*	3 13 3	22/3	16/6
Anglo-Portuguese Tel.	£1	20/-	+3d	9	9	9 0 0	25/-	18/9
Arcolectric	1/-	4/6		15	15	3 6 9	6/-	3/9
Aron Meters	5/-	22/6	−3/9	15	15	—	30/-	17/-
Assoc. Elec. Ind.	£1	30/9	+6d	15	15	9 15 0	48/6	28/9
Babcock & Wilcox	£1	21/9		9	9	—	36/6	19/-
Bakelite	10/-	46/3		17½	17½*	3 15 9	60/-	42/-
Baldwin, H. J.	2/-	1/-		10	Nil	—	1/9	1/-
Berry's Electric	5/-	57/6	+1/-	30	33⅓*	2 19 0	58/6	37/-
Bowthorpe Holdings	2/-	7/9		18½	22	5 13 6	10/3	7/9
Brit. Elec. Resistance	2/-	7/-	+3d	17½	17½*	5 0 0	8/9	6/6
Brit. Elec. Traction: Def. Ord. " A "	5/-	50/6	+1/9	40	50	4 19 0	57/6	41/9
British Electronic Ind.	5/-	10/3		—	15	7 6 3	15/3	8/9
B.I. Callender's	£1	57/-	+1/6	13½	13½	4 14 9	62/3	49/6
B.I. Callender's 6% Pref.	£1	17/-	+6d	6	6	7 1 3	18/3	16/6
British Thermostat	5/-	31/3	+6d	20	27½	4 8 0	40/-	28/-
Brook Motors	10/-	50/6	−9d	25	25*	4 19 0	55/-	47/-
Bruce Peebles	10/-	16/-	+6d	10	Nil	—	21/-	13/3
Bulgin, A. F.	1/-	12/3		55	40*	3 5 3	13/3	7/9
Bulpitts	5/-	16/-	−9d	15	16¼	5 1 6	27/6	16/-
Burco Dean	5/-	6/6		18	15	11 11 0	11/9	6/3
Cable & Wireless	5/-	18/-	+9d	10	10*‡	2 15 6	19/9	12/6
Cambridge Instruments	5/-	31/-		12½†	22	3 11 0	38/6	30/-
Chloride El. Storage " A "	£1	72/6		17½	20	5 10 3	91/-	72/-
Clarke Chapman	£1	40/-		13¾	13¾	6 17 6	54/-	37/6
Clarke, T.	2/-	4/-		16	16	5 6 9*	5/3	3/6
Combined Elec. Mfrs.	4/-	7/-		—	12½	7 2 9	10/-	6/9
Contactor Switchgear	5/-	14/3	+1/-	14	14	4 18 3	16/-	12/6
Crabtree	10/-	23/-		20	12½*	5 8 9	33/9	23/-
Crompton Parkinson	5/-	12/9	+6d	12½	12½	4 18 0	14/6	11/3
De La Rue	10/-	46/6	+2/-	22½	22½*	4 16 9	70/-	44/6
Decca " A "	10/-	59/6	+3/6	23⅓	23⅓	3 18 6	70/-	52/3
Desoutter	5/-	55/-		30	35	3 3 9	68/9	49/-
Dewhurst	2/-	5/3		20	20	3 16 3*	6/6	3/9
Dictograph Tel.	2/-	10/9	+3d	20	20*	3 14 6	13/-	8/6
Dimplex	5/-	55/6	+2/-	30	35*	1 17 9*	55/6	28/3
Dubilier Condenser	1/-	2/-		30	15*	7 10 0	3/-	2/-
Duport	5/-	10/6	+3d	17½	20	6 7 0*	17/-	10/3
E.M.I.	10/-	35/9	+3d	17½	17½	4 18 0	51/3	35/3
Eleco	2/-	9/3	+9d	20	20*‡	4 6 6	10/6	4/3
Electrical Apparatus	5/-	20/-		20	22	5 10 0	21/-	17/-
Electrical Components	5/-	8/6		11½	12½	7 7 0	9/9	7/9
Elec. Construction	£1	20/9	+9d	9	5	4 16 6	39/-	20/-
Elliott-Automation	5/-	34/9	+9d	9·3	13	1 17 6	37/6	25/6
Enfield Rolling Mills	£1	38/6	+6d	15	15	7 15 9	51/6	37/6

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

issue and a " rights " issue in the proportion of two new shares at 5s for every five held. The new shares are not to participate in the 7½ per cent interim dividend for 1960–61 (already declared) but will qualify for the final payment of 8 per cent which is forecast by the directors and will, in effect, mean a total distribution larger than the 17½ per cent rate of dividend paid for each of the past seven years. Profits in the year just ended are expected to show an increase of around £100,000, and work on hand is stated by the directors to be well above last year's level.

Electrical Investments

Company or Board	Nom. Value	Middle price 6th Nov.	Week's Rise or Fall	Dividend Pre-vious	Dividend Last	Yield %	1961 High-est	1961 Low-est
Electrical Shares—continued						£ s d		
English Electric	£1	28/6	+1/-	10	10	7 0 3	40/9	26/3
English Electric 3¾% Pref.	£1	10/6		3¾	3¾	7 13 9	11/9	9/9
Ever Ready	5/-	38/-		20	22½	2 18 0	40/-	31/6
Falk Stadelmann	£1	23/-	+1/3	7½	8¾	7 12 3	26/-	21/9
G.E.C.	£1	26/3	+1/6	10	10	7 12 6	39/6	24/3
G.E.C. 6½% Pref.	£1	16/6		6½	6½	7 17 6	19/3	16/6
General Cables	5/-	4/9		15	Nil	—	6/3	4/9
G.H.P. Group	£1	19/-	−6d	6	7‡	7 7 3	24/6	17/-
Goblin (B.V.C.)	5/-	4/6		12½	10	11 2 0	8/6	4/3
Hackbridge Holdings	5/-	5/6	+3d	20	10*	9 1 9	6/9	5/-
Harland Engineering	5/-	12/6		16	16	6 8 0	19/-	12/-
Head Wrightson	5/-	20/-		14	16	4 0 0	30/-	20/-
Heatrae	2/-	16/9	+9d	12½	25	2 19 9	19/-	12/6
Holophane	5/-	16/9		30	30	8 19 0	20/6	14/6
Hoover	5/-	49/6		90	45*	4 11 0	55/6	37/6
Hunt, A. H.	4/-	17/9	+3d	20	20	4 10 3	25/9	17/6
Intl. Combustion	5/-	23/9	+1/-	20	30	6 6 3	33/9	22/9
Intl. Computers & T.	£1	90/-		10	11¼	2 10 0	107/-	59/-
Johnson & Phillips	£1	20/-	+9d	Nil	5	5 0 0	24/-	17/6
Kenwood Mfg.	1/-	3/3		—	—	—	6/-	3/3
Laurence Scott	5/-	14/9	+6d	15	15	5 1 9	18/9	14/3
Lister, R. A.	£1	52/-	+1/-	14	14	5 7 9	56/9	45/6
Lucas, J.	£1	50/9	+9d	12½	13¾	5 8 6	71/6	50/-
Marryat & Scott	2/-	16/9		27½	32½	3 17 6	18/6	13/9
Mather & Platt	£1	36/9	+9d	11	11	5 19 6	51/6	36/-
Metal Industries	£1	48/9	+2/6	15	15	6 3 0	66/6	46/3
Midland Elec. Mfg.	£1	52/6		12	12	4 11 6	67/6	52/6
Murex	£1	39/-	+1/6	20	13*	6 13 3	51/6	37/6
Newman Ind.	2/-	7/-		12½	15	4 5 9	7/6	5/-
Oldham & Son	1/-	2/6		17½	17½*	7 0 0	3/-	2/3
Parmiter, Hope & S.	1/-	2/-		12½	20	10 0 0	2/5	1/6
Parsons, C. A.	£1	48/9		9⅜	12½	5 2 6	72/6	46/9
Philips' Lamps	Fl.10	220/-		16	16*	1 9 0	£13¼	£9¾
Plessey	10/-	41/-	+2/-	17	15*‡	3 13 3	45/-	35/3
Pullin Group	2/-	10/6	+6d	25	25	4 15 3	15/-	10/-
Pyrotenax	5/-	42/-	+9d	40	45	4 0 0*	48/9	34/9
Radiation	£1	22/6		12	10	8 17 9	37/6	22/6
Reliance-Clifton	5/-	18/3		15	20	3 13 0*	22/-	14/9
Reyrolle	£1	38/3		17½	9¾*	5 2 0	51/6	36/6
Richardsons Westgarth	10/-	4/-		8⅓	Nil	—	8/3	4/-
Sanders, W. H.	2/-	16/6		17½	17½‡	2 2 6	28/3	14/-
Sangamo Weston	10/-	21/3	+6d	13⅓	10‡*	4 14 0	25/9	18/9
Scott, James	5/-	29/6	−6d	25	27½	4 13 3	32/-	25/6
Simon Engineering	5/-	33/6	+1/-	—	27½	4 2 0	43/9	28/-
Smith (England), S.	4/-	14/9	+1/-	17½	20	5 8 6	23/9	13/9
Southern Areas	£1	17/-		5	6	7 1 3	23/-	14/6
Strand Elec.	5/-	16/3		14·6	20	6 3 0	20/-	12/3
Sturtevant	5/-	9/9	+6d	15†	13†	10 18 0	18/6	9/-
Sun Elec.	5/-	14/3		15	18½	6 9 6	17/6	14/3
T.C.C.	10/-	40/-	−1/3	35	22½*	5 12 6	43/9	40/-
Telephone Rentals	5/-	26/-		15	15‡*	2 17 3	29/6	18/6
Thompson (John)	5/-	12/9		20	5	—	16/9	12/9
Thorn Elec.	5/-	57/-	+9d	25	25	2 3 9	63/-	44/6
Thornycroft	4/-	5/3		6	—	—	7/-	5/-
Tube Investments	£1	64/-	+4/-	—	14	4 7 6	85/-	54/-
Ultra Electric	5/-	18/9	+1/3	20	25	—	31/3	12/6
Walsall Conduits	4/-	10/3	+6d	15	15	5 17 0	15/-	9/9
Ward & Goldstone	5/-	26/6	−6d	35	17½*	3 6 0	36/6	25/6
Watford	2/-	6/9	+3d	25	20*	5 18 6	10/9	6/6
Westinghouse	£1	25/9	+1/3	11	11	8 10 6	45/-	24/6
West, Allen	5/-	10/3		12½	13½	6 11 9	14/6	10/3
Wilkins & Mitchell	5/-	8/3	−6d	21	12	7 5 6	15/3	8/3
Wolf Electric	5/-	12/9		12½	13¾	5 7 9	17/6	12/9

Falk Stadelmann

A final dividend from Falk Stadelmann brings the total for 1960–61 to 8¾ per cent and goes half way towards restoring last year's cut in the rate from 10 to 7½ per cent. At £493,000 the group trading profit is only a little above the previous figure, and covers with a rather narrow margin the amount distributed in dividends. With six months of the current financial year already gone, however, the directors are encouraged by an increase in sales during this period, and by the volume of incoming orders, to regard prospects more favourably. The electrical sections of the business have evidently been making the main contribution to the parent company's progress. Following these statements the £1 shares improved to 23s and are now on a yield basis of over 7½ per cent.

Pyrotenax Issue

A one-for-three scrip issue distributed last month by Pyrotenax brings the company's issued ordinary capital to a total just above the million mark and places the shares consequently in the category of shares which qualify for the investment of Trust money. In their " ex-capitalisation " form the 5s shares have been quoted around 42s to yield 4 per cent, assuming a proportionate reduction in the distribution of 45 per cent (including 5 per cent as bonus) made for the year ended last March. The rate of growth in the parent company's business slowed down a little in the early part of this year, but was said by the chairman in July to have re-established an upward trend.

Contactor Switchgear

An improvement to £182,000 in the profits of Contactor Switchgear in the twelve months up to July more than recovered the setback of 1959–60, when earnings fell to £124,000 as a result mainly of the rise in production costs and increased competition. Last year's report referred to the opening of a new factory and to a good inflow of orders, both of which factors, it is to be assumed, contributed to the substantial improvement in the latest figures. There is again no change in the dividend, at a total of 14 per cent, but the rate is now covered well over three times by the net surplus of £83,000, after tax. Having moved up well, on the news, to 14s 3d, the 5s shares of the company offer a yield approaching 5 per cent.

REPORTS and DIVIDENDS

Falk, Stadelmann & Co., Ltd., is raising its dividend from 7½ per cent to 8¾ per cent for the year ended 31st March, 1961. Group trading balance increased from £489,656 to £493,154 and after tax the net profit is up by £4,904 to £108,944. In recommending a 3¾ per cent final dividend, Mr. Hugo Falk, chairman, says that the parent company continued to increase its turnover and trading profit, mainly due to the activity in the electrical sections. Prospects for the current year, based on the first six months' trading, he says, are better than last year.

The cable factories have again had a difficult trading year but the current position appears to be a little brighter due to slightly improved profit margins and higher rate of production. Direct exports show a satisfactory increase, which is continuing in the current year. Orders received are higher than at the corresponding time last year and the rate of incoming orders remains bouyant.

Sterling Cable Co., Ltd.—Group trading profit increased from £130,006 to £171,815 in the year ended 31st March, 1961, and the ordinary dividend is raised from 6½ per cent to 7½ per cent. Profit after taxation is £40,613 (£28,501).

In his address Mr. J. S. Clark, chairman, says the order book remains satisfactorily varied and adequate and output is at a record level. Profit margins are still below the modest 1958-59 level but he is optimistic that the results of the current year's trading will again show improvement. Exports take half the company's output.

Racal Electronics, Ltd.—Philip Hill, Higginson, Erlangers, Ltd., announce that arrangements have been completed for the placing of 300,000 ordinary shares of 5s each at 20s per share in Racal Electronics. Application is being made for Stock Exchange quotation for, and permission to deal in, the whole of the issued share capital of the company, consisting of 1,300,000 ordinary shares of 5s each.

Profits have expanded from £13,534 in 1956 to £182,436 in 1960-61. The directors believe that profits for the year to 31st January, 1962, will be not less than those for last year and they forecast a 17½ per cent dividend. This would be covered 2·4 times, leaving a retained profit of £50,000.

The company's principal customers are Government Departments and international organisations throughout the world and its export sales amounted to some 34 per cent of total turnover during the year ended 31st January, 1961; in the first eight months of the current year these sales have increased to approximately 44 per cent.

The policy of the group is to develop sales of its proprietary equipments, and the order book now stands at a record level. The new developments in hand and the current high level of demand for the group's products lead the directors confidently to expect that the overall level of turnover for the current year will be more than maintained in the year beginning on 1st February, 1962.

G. & J. Weir Holdings, Ltd., is maintaining its interim dividend at 3·6d per 5s unit in respect of the current year. A total of 10·8d per unit was paid for 1960.

The directors report that results for the first eight months of 1961 have been below expectations and final results should be " substantially below last year." On the other hand, they add, orders received have considerably improved although profit margins remain low.

Gas Purification & Chemical Co., Ltd., whose subsidiaries include Grundig (Great Britain), made a loss of £14,872, before tax, in the year ended 30th June, 1961, and no dividend is recommended. A 20 per cent final made 35 per cent for 1959-60. The net loss of £45,959 compares with a previous profit of £397,726.

Tube Investments, Ltd., announce a final dividend of 7 per cent, making a total of 14 per cent for the year to 31st July, 1961, on the £35,341,313 ordinary capital. Group trading profit, before tax, of £27,161,023, showed an increase of £3,048,735, and the net profit is up from £9,923,838 to £10,364,746 after tax of £10,729,225 (£9,663,793).

Contactor Switchgear, Ltd.—A final dividend of 10 per cent, again making 14 per cent, is to be paid for the year ended 31st July, 1961. Profits for the year increased from £124,170 to £181,901 and net profit, after tax of £98,864, amounted to £83,037, an increase over the previous year of £24,828.

Bulpitt & Sons, Ltd.—Interim dividend 5 per cent (the same).

Meetings of Creditors

Ratcliff (Electric), Ltd.—Meeting of creditors at 93, Queen Street, Sheffield, 1, on 16th November pursuant to Section 293 of the Companies Act, 1948.

Home Electrical Products, Ltd., and **Home Electrical Products (Northern), Ltd.**—Meeting of creditors on 13th November at 14, Manor Road, Coventry, in respect of both companies, for the purposes mentioned in sections 294 and 295 of the Companies Act, 1948.

Winding-Up Petitions

Snelsons Electrical (M/cr), Ltd.—A petition has been presented for the winding up of the company and is to be heard in the High Court on 13th November. Anyone intending to appear should notify Cochrane & Cripwell, 119, Finsbury Pavement, London, E.C.2, today (Friday).

Valcon Electrical, Ltd.—A petition has been presented for the winding up of the company and is to be heard in the High Court on 13th November. Anyone intending to appear should notify Godfrey Warn & Co., 1, New Square, Lincoln's Inn, London, W.C.2, today (Friday).

Liquidations

Winding-up proceedings or liquidations are often undertaken for the purpose of reconstruction, the transfer of a business, or other reasons. The appearance of a company's name under this heading therefore does not necessarily indicate insolvency.

Davis Bros. (Electrical), Ltd., 1, Vernon Road, Romford, Essex, electrical dealers.—Meetings of creditors and contributories today (Friday) at Inveresk House, 346, Strand, London, W.C.2.

Allray Electrical & Engineering Co., Ltd., 309, Western Avenue, Cardiff, Glam., electrical contractors.—Meetings of creditors and contributories 17th November at the Official Receiver's Office, County Court Buildings, Westgate Street, Cardiff.

Valley Electrics, Ltd., 65, Potternewton Lane, Leeds, 7, dealers in domestic appliances.—Last day for receiving proofs for dividend 14th November. Liquidator: Mr. N. Saddler, Pearl Chambers, East Parade, Leeds.

Woodgrange Electric, Ltd., electrical equipment retailers, 30, Woodgrange Road, Forest Gate, London, E.7.—Winding up voluntarily. Liquidator, Mr. L. C. Curtis, 13, Wimpole Street, London, W.1, appointed 18th October. Particulars of claims to the liquidator by 28th November.

Bankruptcies

J. E. Stephens, lately carrying on business under the name of J. Edryd Stephens & Sons at 10, Barn Road, Carmarthen, electrical engineer.—Last day for receiving proofs for dividend 15th November. Trustee, Mr. H. Lord, 2, St. Mary Street, Cardigan.

P. H. Mathews, manufacturer of ironware and electrical fittings, carrying on business at 32, Parkfield Street, London, N.1.—First and final dividend of 18s 9⅜d in the £ payable at Bankruptcy Buildings, Carey Street, London, W.C.2.

N. Pilling, lately carrying on business as an electrical contractor at 48, Bury Road, Radcliffe, Lancs.—First and final dividend of 4⅝d in the £ payable 14th November at the Official Receiver's Office, 20, Byrom Street, Manchester, 3.

C. T. Powell, carrying on business at Station Road, Wilmslow, Lancs., as an electrical engineer under the style of George Cooke & Co.—Order for discharge made 5th October, suspended for twelve months.

R. A. Gibson and **P. L. Long**, lately carrying on business in co-partnership under the style of Gibson & Long, at 9, Beech Road, Horfield, Bristol, electrical and plumbing engineers.—Last day for receiving proofs for dividend 15th November. Trustee, Mr. G. C. Ehlers, 28, Baldwin Street, Bristol, 1.

T. A. Edwards, sole proprietor of Edwards Electrical & Radio (a firm), residing and carrying on business at 384, Finchley Road, Hampstead, London, N.W.2, as a radio retailer and electrical engineer.—Trustee, Mr. A. A. Walter, Bankruptcy Buildings, Carey Street, London, W.C.2, released 16th October.

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1957

2382. Electric & Musical Industries, Ltd.—Apparatus for manipulating pulse code modulated signals. 23rd January, 1958. (880259.)

4375. English Electric Co., Ltd.—Electromagnetic induction pumps. 5th February, 1958. (880316.)

4428. Associated Electrical Industries, Ltd.—Electric circuit arrangement for position control systems. 6th February, 1958. (880375.)

5901. English Electric Co., Ltd.—Shrouds for electrical cable connections. 14th February, 1958. (880376.)

8492. A. Reyrolle & Co., Ltd.—Mining control systems for electric motors. 14th March, 1958. (880102.)

12093. General Electric Co., Ltd.—Sodium vapour electric discharge lamps. 14th April, 1958. (880319.)

13850. Telegraph Condenser Co., Ltd., and Sporing, P. A.—Cylindrical electrical condensers. 9th April, 1958. (880168.)

14832. Postmaster General.—Transistor oscillator circuits. 1st May, 1958. (880377.)

17744. Associated Electrical Industries, Ltd.—A.c. electric traction equipment including rectifiers. 2nd June, 1958. (880378.)

23022. United Kingdom Atomic Energy Authority.—Pressure vessels. 8th July, 1958. (880092.)

23710. Telegraph Condenser Co., Ltd., and Sporing, P. A.—Metal cased cylindrical electrical condensers. 21st May, 1958. (880169.)

28677. British Insulated Callender's Cables, Ltd.—Two-part couplings for multiple conductor cables. 10th September, 1958. (880407.)

1958

1450. Vactric (Control Equipment), Ltd.—Rotary electric switches. 14th April, 1959. (880097.)

2294. Telefunken G.m.b.H.—Speed control systems for electric motors. 23rd January, 1958. (880285.)

3410. Telefunken G.m.b.H.—Electric circuit assemblies. 3rd February, 1958. (880322.)

5679. English Electric Co., Ltd.—Dynamo-electric machines. 15th May, 1959. (880262.)

8964. Philips Electrical Industries, Ltd.—Line saw-tooth generators for use in television circuits. 20th March, 1958. (880101.)

10883 National Research Council.—Electronic control circuit. 3rd April, 1958. (880157.)

24449. Soc. Elettrotecnica Chimica Italiana, and Canegallo, G.—Electrical resistors. 29th July, 1958. (880288.)

25043. Patent - Treuhand - Gesellschaft für Elektrische Glühlampen.—Wall-stabilised electric high pressure gaseous discharge lamp. 5th August, 1958. (880422.)

25889. General Electric Co., Ltd.—Apparatus for controlling the sequential operation of switch means and electric motor control arrangements including such apparatus. 10th August, 1959. (880026.)

28340. Siemens-Schuckertwerke A.G.—Magnetic amplifier arrangements. 3rd September, 1958. (880290.)

39710. National Research Development Corporation.—Electrical timing arrangements. 9th December, 1958. (880028.)

40024. Robertshaw-Fulton Controls Co.—Capacitance type temperature control. 11th December, 1958. (880415.)

40632. Gerrard, M. C.—Protective arrangements for electric circuits and apparatus. 15th December, 1959. (880238.)

42217. Siemens & Halske A.G.—Contact devices comprising magnetic contact springs in sealed protective tubes. 31st December, 1958. (880241.)

1959

4463. British Electrical & Allied Industries Research Association.—Device for use in determining moisture content. 3rd February, 1960. (880395.)

7362. Taylor, K. A.—Combination light fittings and cable ducts. 3rd March, 1959. (880243.)

9258. Marconi's Wireless Telegraph Co., Ltd.—Counting circuits. 21st September, 1959. (880119.)

11957. J. A. Crabtree & Co., Ltd., Morgan, R. W., Heath, R., and Macnaughton, W. A.—Lampholders. 14th March, 1960. (880348.)

12597. Durowe A.G.—Electric wristlet watch. 14th April, 1959. (880121.)

13700. Telephone Manufacturing Co., Ltd.—Electrical signal transmission systems. 6th April, 1960. (880160.)

14183. British Rayon Research Association.—Electrical detecting apparatus particularly for textile machinery. 3rd May, 1960. (880174.)

15680. Minister of Aviation.—Electrical cavity resonators, waveguides or the like. 20th July, 1960. (880390.)

16683. Belling & Lee, Ltd.—Electrical terminal blocks. 15th May, 1959. (880218.)

20111. A. Reyrolle & Co., Ltd.—Gas-filled electric bushing insulators. 9th June, 1960. (880275.)

26704. General Motors Corporation.—Electrical oscillator circuits. 5th August, 1959. (880365.)

26705. General Motors Corporation.—Electrical mixer circuits. 5th August, 1959. (880366.)

26808. United-Carr Fastener Corporation.—Multiple contact connectors. 5th August, 1959. (880225.)

27030. Westinghouse Brake & Signal Co., Ltd.—Selenium rectifiers. 5th August, 1960. (880367.)

27186. Electric & Musical Industries, Ltd.—D.c. restoration circuits. 5th August, 1960. (880247.)

27692. A. H. Hunt (Capacitors), Ltd.—Electrical capacitors. 8th August, 1960. (880249.)

42574. Marconi's Wireless Telegraph Co., Ltd.—Television signal converting apparatus. 1st July, 1960. (880053.)

43512. Telefunken G.m.b.H.—Magnetic signal storing and/or reproducing apparatus. 22nd December, 1959. (880327.)

43676. General Railway Signal Co.—Electric display indicator systems. 23rd December, 1959. (880078.)

1960

3135. Bendix Corporation.—Electrical condensers. 28th January, 1960. (880083.)

9832. Telefunken G.m.b.H.—Methods of sealing lead-in wires to vitreous members. 21st March, 1960. (880210.)

11586. National Research Council.—Electronic control circuit. 3rd April, 1958. (880158.)

25875. Motorola, Inc.—Electronic communication equipment. 25th July, 1960. (880091.)

27744. International Business Machines Corporation.—Semiconductor devices. 10th August, 1960. (880216.)

Trade Mark Applications

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 25th November.

Simto. No. 816,124. Class 7. Domestic dish-washing and food-mixing machines.—Inman & Inman, trading as Simto Sales, Hey Street, Bradford, 7.

Vimarc. No. 818,914. Class 7. Electric motors.—British Manufacture & Research Co., Ltd., Springfield Road, Grantham, Lincs.

Thermees. No. 802,120. Class 9. Electric arc welding electrodes.—English Electric Co., Ltd., English Electric House, Strand, London, W.C.2.

El-Stat. No. 809,865. Class 9. High voltage electrical apparatus for the control of electrostatic charges used in flocking processes.—L. Allen, trading as Allen Maintenance (Industrial Electronic), 174, Oxford Road, Manchester, 13.

Bailey Meters (design). No. 817,494. Class 9. Apparatus for giving visible and/or audible warning of failure in industrial operations and for automatically controlling such operations; apparatus for indicating and recording the values of physical variables in industrial installations; voltage regulators; and electrical switches for the remote control of electrical devices.—Bailey Meters & Controls, Ltd., Purley Way, Croydon, Surrey.

Delcar. No. 819,227. Class 9. Electrodes for electric welding.—Deloro Stellite, Ltd., Highlands Road, Shirley, Solihull, Warwickshire.

Frigeco. No. 819,230. Class 9. Electrical apparatus and instruments. No. 819,231. Class 11. Refrigerators, refrigerating installations, and parts.—Frigeco, S.A. Address for service: Baron & Warren, 16, Kensington Square, London, W.8.

NuMang. No. 820,876. Class 9. Electrodes for electric welding.—Lincoln Electric Co., Ltd., Black Fan Road, Welwyn Garden City, Herts.

Filtromat. No. 796,270. Class 11. Electrically heated and gas heated apparatus for making coffee.—Wurttembergische Metallwarenfabrik, Germany. Address for service: Reddie & Grose, 6, Bream's Buildings, London, E.C.4.

Syntomatron. No. 819,062. Class 9. Electronic tubes (not for lighting purposes).—Compagnie Française Thomson-Houston, France. Address for service: Baron & Warren, 16, Kensington Square, London, W.8.

Lexsam. No. 817,142. Class 11. Electrical and gas heated catering and cooking appliances.—Kitchen Supplies, Ltd., Lexington House, 12-26, Lexington Street, Piccadilly, London, W.1.

Leaf design. No. 819,032. Class 11. Electric boiling rings, fires, heaters, hair-drying appliances (not machines), toasters, table lamps, portable lamps and torches.—Chilton Electric Products, Ltd., Hungerford, Berks.

Mabelec. No. 820,918. Class 11. Electric lighting apparatus and fittings.—Manufacture Belge de Lampes et de Matériel Electronique, Belgium. Address for service: T. D. Threadgold, Century House, Shaftesbury Avenue, London, W.C.2.

Aerialite Popular. No. 821,919. Class 11. Cabinets for drying clothes.—Aerialite, Ltd., Castle Works, Stalybridge, Ches.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Argentina.—State River Fleet Organisation. 29th November. Freezing plants. (E.S.B. 34079/61.)*

Australia.—State Electricity Commission of Victoria. 27th November. Power line carrier h.v. coupling apparatus. (E.S.B. 33141/61.)*

Postmaster General's Department. 30th November. Plugs and covers. (E.S.B. 33701/61.)* 14th December. Cable. (E.S.B. 33715/61.)*

Burma.—Union Purchase Board, Rangoon. 20th November. Cable. (E.S.B. 34050/61.)* Fluorescent lamps. (E.S.B. 34051/61.)* Switch-fuses. (E.S.B. 34049/61.)* Electric motors and starters. (E.S.B. 34048/61.)* Switchboard. (E.S.B. 34052/61.)* 23rd November. 1,000 pin insulators. (E.S.B. 33719/61.)* 150 ceiling fans. (E.S.B. 33718/61.)*

Canada.—Manitoba Hydro, Winnipeg. 5th December. 230 kV circuit-breakers and central air compressor plants. (E.S.B. 33756/61.)*

Dartford.—Borough Council. 28th November. Group "B" street lighting, Temple Hill, site 2C; and Group "A" street lighting, Watling Street (Stone Parish). T. Armstrong, town clerk, Council Offices.

Godstone.—R.D.C. 22nd November. Two 5in diameter submersible pumps, driven by 10 h.p. motors, for Burstow sewage disposal works; engineer and surveyor, Council Offices, Oxted.

Hong Kong.—Wireless Division, G.P.O. 19th January, 1962. Radio distribution systems for Queen Elizabeth Hospital. (E.S.B. 34042/61.)*

India.—Punjab State Electricity Board. 20th December. Outdoor type oil immersed, naturally cooled power transformers. (E.S.B. 34060/61.)*

Singareni Collieries Co., Ltd., Deccan. 11th December. Electric vibratory feeders. (E.S.B. 33479/61.)* 12th December. Flameproof air-break oil immersed d.o.l. starters. (E.S.B. 33480/61.)*

Ipswich.—Borough Council. 27th November. 82 Group "B" street lighting columns and sodium discharge lanterns, lamps and control gear. (See Classified Advertisement Section.)

Iraq.—Directorate of Contracts and Purchases, Baghdad. 22nd November. Two 250 kW semi-portable generating sets. (E.S.B. 34021/61.)*

Ministry of Municipalities. 25th November. Generating sets and ancillary equipment, Abu Saida and Al-Mansooriyah. (E.S.B. 34026/61.)* 16th December. H.v. insulators, switches, h.v. fuses and wooden rods. (E.S.B. 34025/61.)*

Iraqi Ports Administration, Basrah. 26th November. Cables. (E.S.B. 34016/61.)*

Ministry of Oil. 28th November. Telephone exchange. (E.S.B. 34027/61.)*

Ministry of Defence. 24th January, 1962. Transformer substation at Al Habbania Camp. (E.S.B. 34019/61.)*

Kuwait.—Department of Electricity, Water and Gas. 3rd December. Wiring accessories. (E.S.B. 34029/61.)*

New Zealand.—Corporation Electricity Department, Dunedin. 17th November. Insulated cables. (E.S.B. 33461/61.)*

Pakistan.—Electricity, Water and Power Development Authority, Lahore. 27th November. Cable boxes. (E.S.B. 33485/61.)*

Director-General, Supply and Development, Karachi. 6th December. Switchboards. (E.S.B. 33795/61/I.C.A.)*

West Pakistan Water and Power Development Authority, Lahore. 19th December. Seven 33 kV and 66 kV substations. (E.S.B. 33777/61/D.L.F.)*

Peterborough.—R.D.C. 5th December. Mobile alternator unit for sewerage pumping station. (See Classified Advertisement Section.)

Rhodesia and Nyasaland.—Federal Power Board. 1st December. Fixed v.h.f./u.h.f. radio equipment. (See Classified Advertisement Section.)

South Africa.—Stores Department, South African Railways. 1st December. Cable. (E.S.B. 34037/61.)* 6th December. 10,000 lampholders. (E.S.B. 34035/61.)* 15th December. Portable electric motor-driven welding sets. (E.S.B. 34036/61.)*

Durban City Council. 2nd December. Telephone cable. (E.S.B. 34339/61.)*

Sudan.—Controller of Stores, Sudan Railways, Atbara. 5th December. Generating sets. (E.S.B. 33799/61.)*

Thailand.—State Railways. 12th December. Telephone and telegraph system. (E.S.B. 34064/61.)*

Workington.—West Cumberland Water Board. 20th November. Supply and installation of an electrically driven horizontal centrifugal pump, together with starter, control gear, etc., for proposed booster station at Low Liza Bridge, Lorton. F. Clapham, Clerk of the Board, Stoneleigh, Park End Road.

Worksop.—Borough Council. 27th November. Removal of existing street lighting standards and supply, erection and servicing of new units. (See Classified Advertisement Section.)

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Alnwick.—Girls' grammar school; Northumberland county architect, 30, Great North Road, Newcastle-on-Tyne.

Andover.—Factory extension; Riley & Neate, Ltd., Anton Mill Road.

Bath.—Factory and offices, Brassmill Lane; Rotork Engineering Co., Lower Mill, Twerton.

Birmingham.—Police training college, Pershore Road; city architect, Baskerville House, Civic Centre, 1.

Bognor Regis.—Extension at Teachers' Training College (£150,000); M. Rainsford Fletcher & Partners, architects, 13, Ambrose Place.

Bristol.—Works extensions; Bristol Siddeley Engines, Ltd., Filton.

Carlisle.—Group laundry at Carlisle General Hospital for Newcastle-on-Tyne Hospital Board; N. Edgar, architect, 72, Warwick Road, Carlisle.

Casterton.—Extensions to secondary modern school (£17,000); county architect, Oakham.

Cheltenham.—Dwellings (75), Arle Road; Dare (Stratford), Ltd., 8, Union Street, Stratford-on-Avon.

Dagenham.—Factory, Oxlow Lane; C. & F. Bryen, Ltd., 170, Hornsey Lane, N.6.

Derby.—Twelve-storey blocks of flats, Bath Street and Brook Street redevelopment areas; borough architect, Council House, Corporation Street.

Dunston-on-Tyne. — Church of St. Nicholas; Newcombe & Newcombe, architects, 23, Elson Square, Newcastle-on-Tyne.

Durham.—Fire brigade training centre at Framwellgate Moor (£48,000); Douglas & Son, contractors, Easington.

Ealing.—Eleven-storey and five-storey blocks of flats, Gurnell Grove development; borough engineer, Town Hall, W.5.

Empingham.—Extension and modernisation of C.E. school (£14,000); county architect, Oakham.

Ennerdale.—Shopping centre, Oregill estate, Egremont; surveyor, Council Chamber, Cleator.

Gillingham.—Houses (76), Wakeley Road, Rainham, Stage 1; borough engineer, Municipal Buildings, Gillingham, Kent.

Grimsby.—Public library (£300,000); borough engineer.

Harrogate.—Bungalows (44), Woodfield estate; J. Sandover & Son, Ltd., 3, Mayfield Grove.

Havant.—Factory and offices; Colt Ventilation, Ltd., 15, Langley Road, Surbiton.

Hoddesdon.—Factory for Morleys (Birmingham), Ltd.; C. L. Nye, Ltd., Caxton Works, Potters Bar.

Huntingdon.—Swimming pool; borough architect, Town Hall.

Kettering.—Houses (25) and bungalows (34), Grosvenor Road estate; Wilsons (Builders), Ltd., Northampton.

Leatherhead.—Dwellings (108), Lilliotts Lane; surveyor, Red House, Bull Hill.

Leeds.—Offices and warehouse, Westgate; Yorkshire Factoring Co., Ltd., 72, Park Lane.

Dwellings (74), Beckett Park; city architect.

Mitcham.—Houses (245), Phipps Bridge redevelopment scheme, Contract No. 5; borough engineer, Town Hall, Mitcham, Surrey.

Newbury. — County modern school (£151,958); Berkshire county architect, Parkside Road, Reading.

Newcastle-on-Tyne. — Eight-storey office block at Gallowgate for Percy Street Investments, Ltd.; L. J. Couves & Partners, architects, Grainger Chambers, Hood Street.

Staines and Wembley.—Showroom and office blocks; Amalgamated Investments & Property Co., Ltd., 56, Grosvenor Street, W.1.

Stoke Newington.—Two blocks of 52 dwellings, Milton Grove and 44 dwellings at Stamford Hill; Howes & Jackman, architects to T.C., 1, Verulam Buildings, Gray's Inn, London, W.C.1.

Sunderland.—Proposed C. of E. school on the Hylton Red House estate; P. R. Middleton & Partner, architects, 111, Albert Road, Middlesbrough.

Surrey.—County primary schools, Tadworth Court and Banstead; county architect, County Hall, Kingston-on-Thames.

Torquay.—Dwellings (100), Cadewell estate; H. B. Kingston, Ltd., 145, London Road, Kingston-on-Thames.

Walton and Weybridge.—Dwellings (124) and shop units (42); Park Investments, Ltd., 98, Park Lane, London, W.1.

Welwyn Garden City.—Resident medical officers' and domestic hostels (£135,000), Welwyn/Hatfield New Hospital, Howlands; regional architect, 40, Eastbourne Terrace, London, W.2.

Winchester.—Hotel, Cathedral Precincts; Trust Houses, Ltd., 53, Shorts Gardens, W.C.2.

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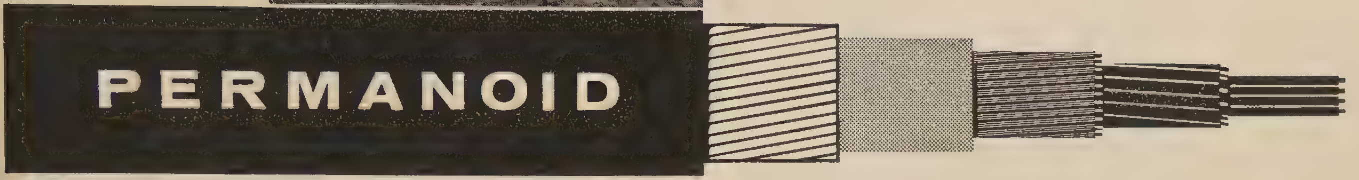
* This information is extracted from the Board of Trade *Export Service Bulletin*. Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.



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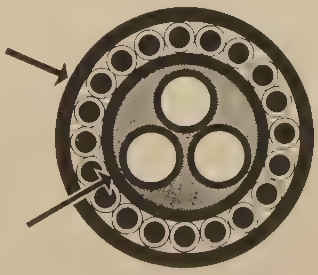

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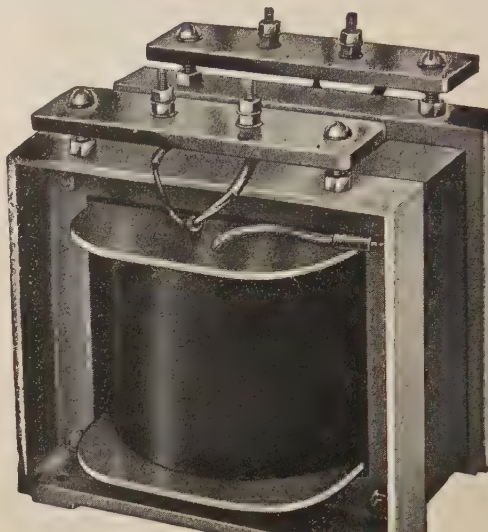

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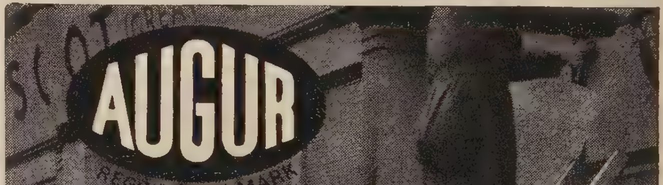

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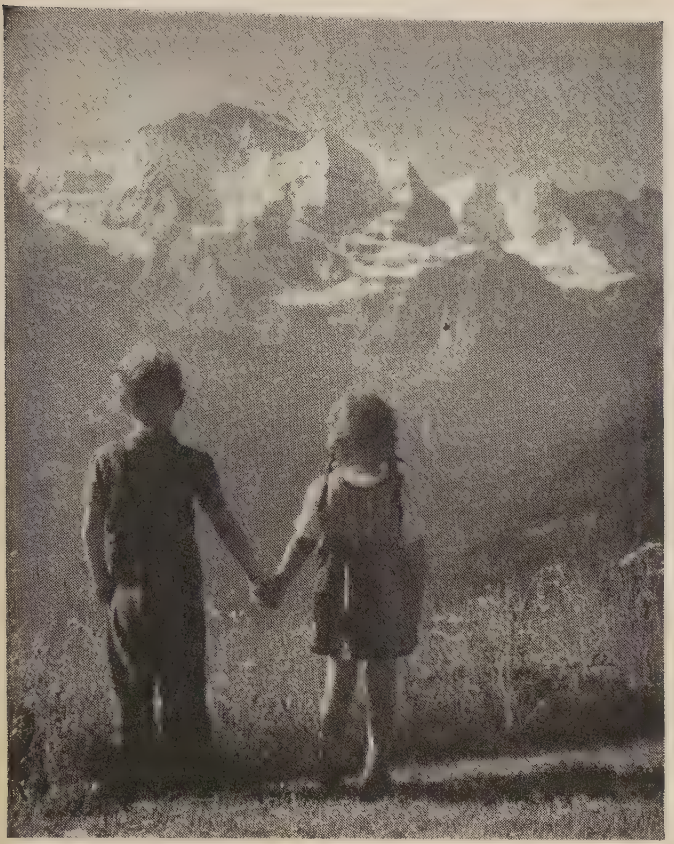

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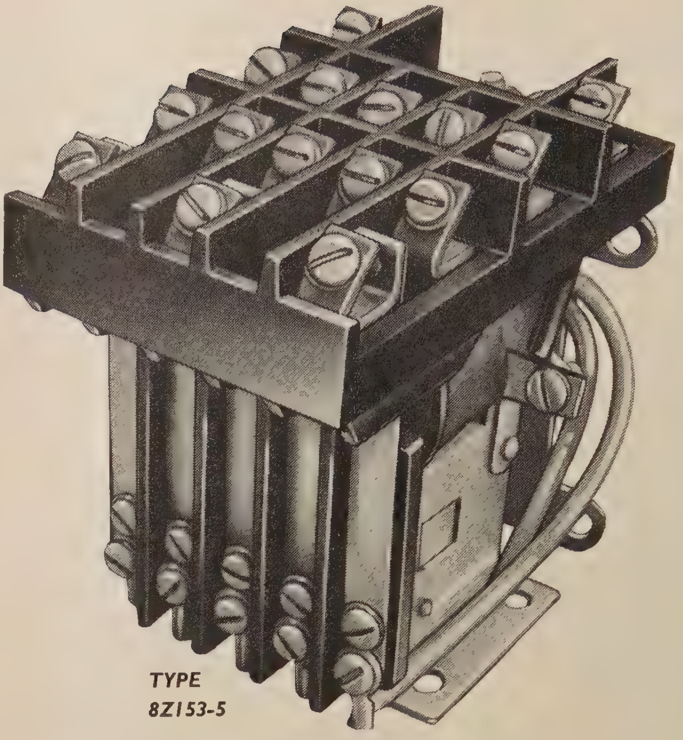

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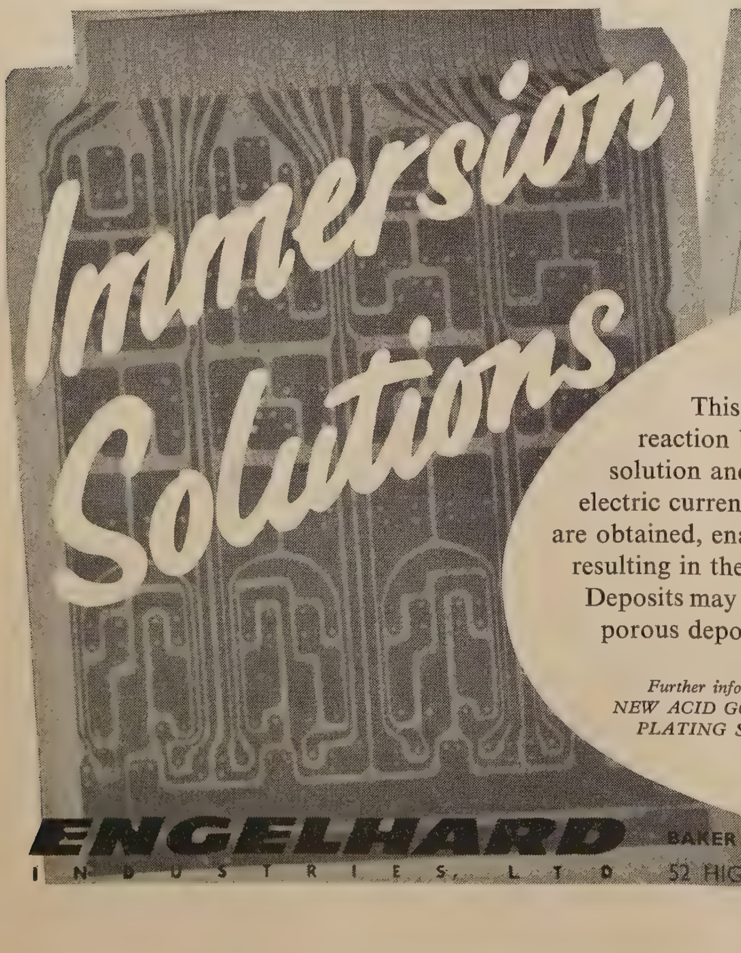

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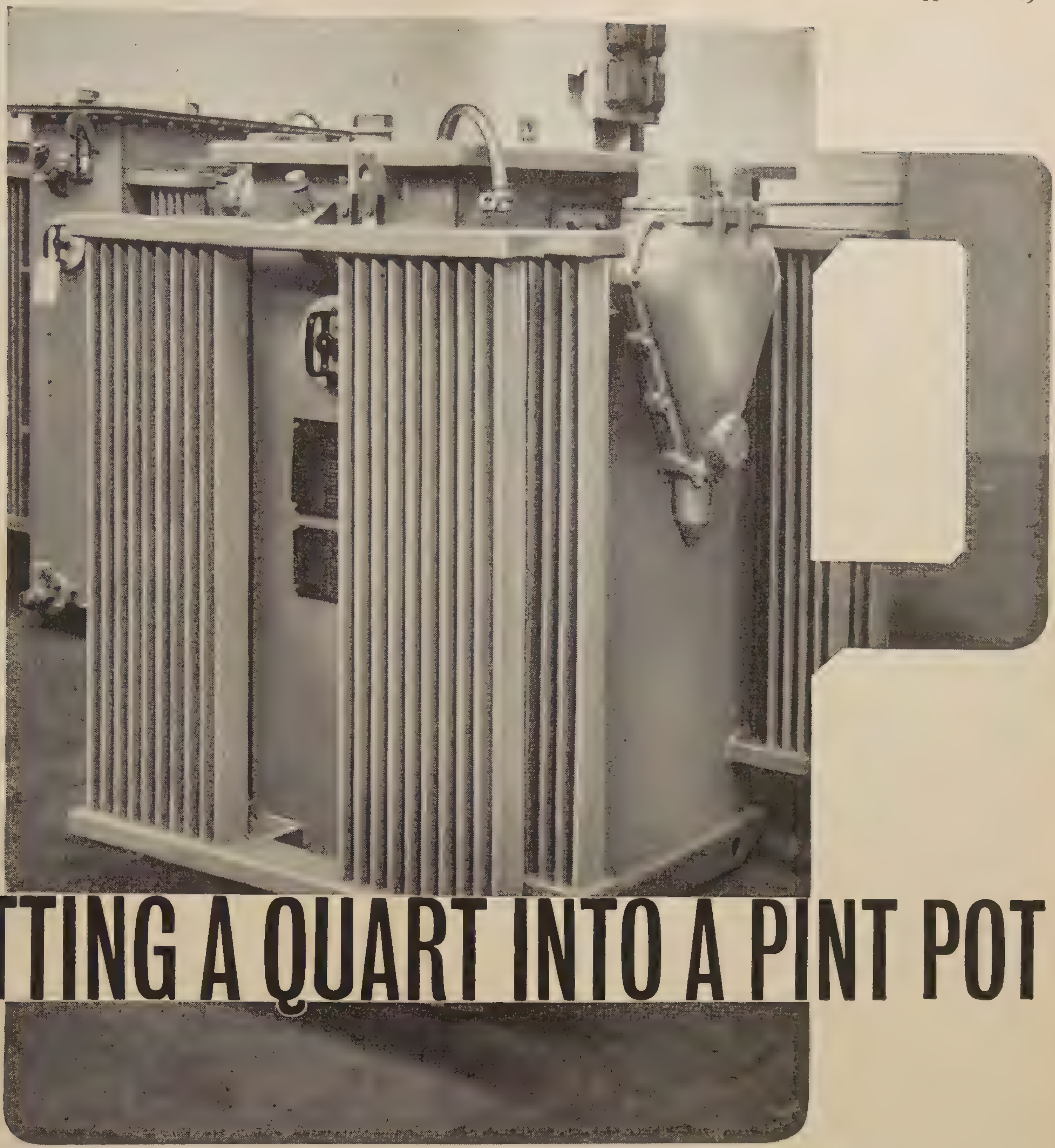

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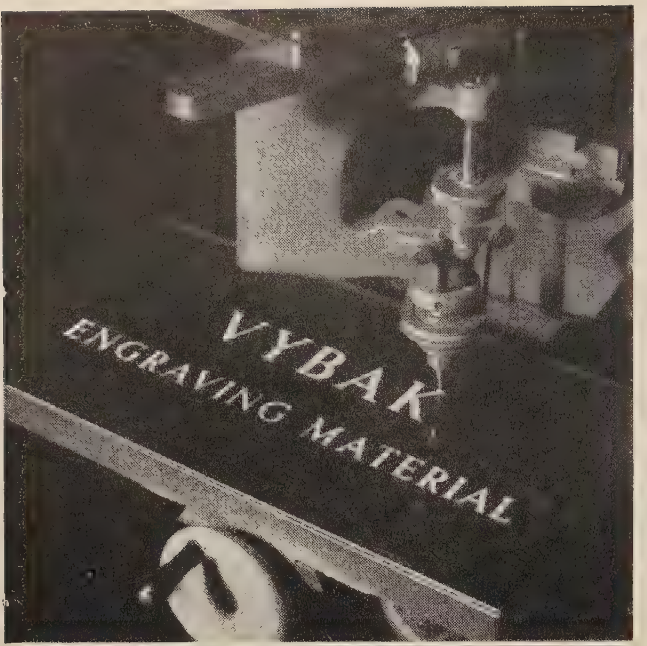

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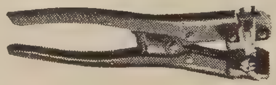

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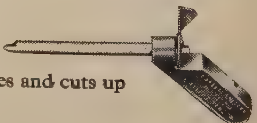

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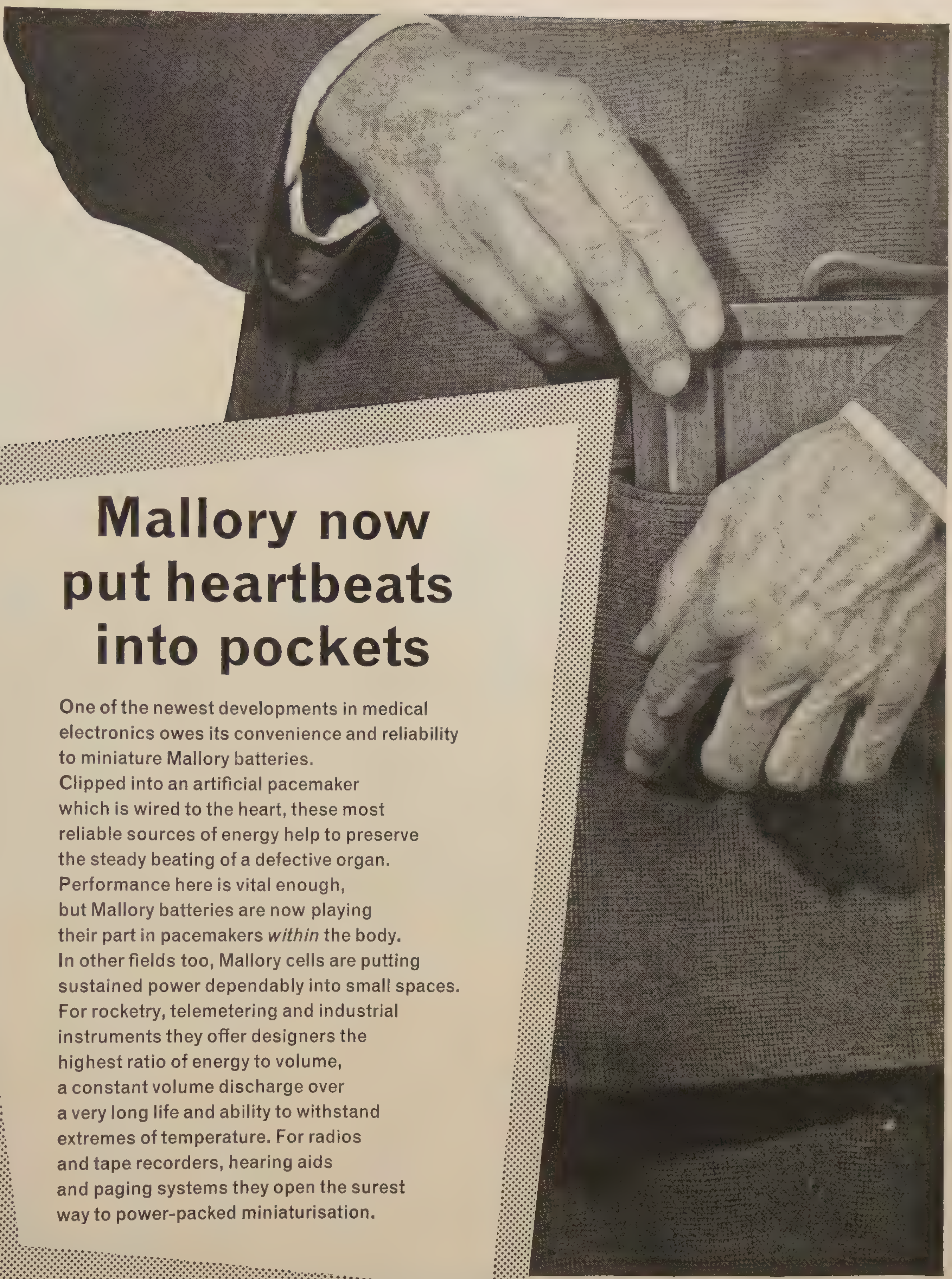

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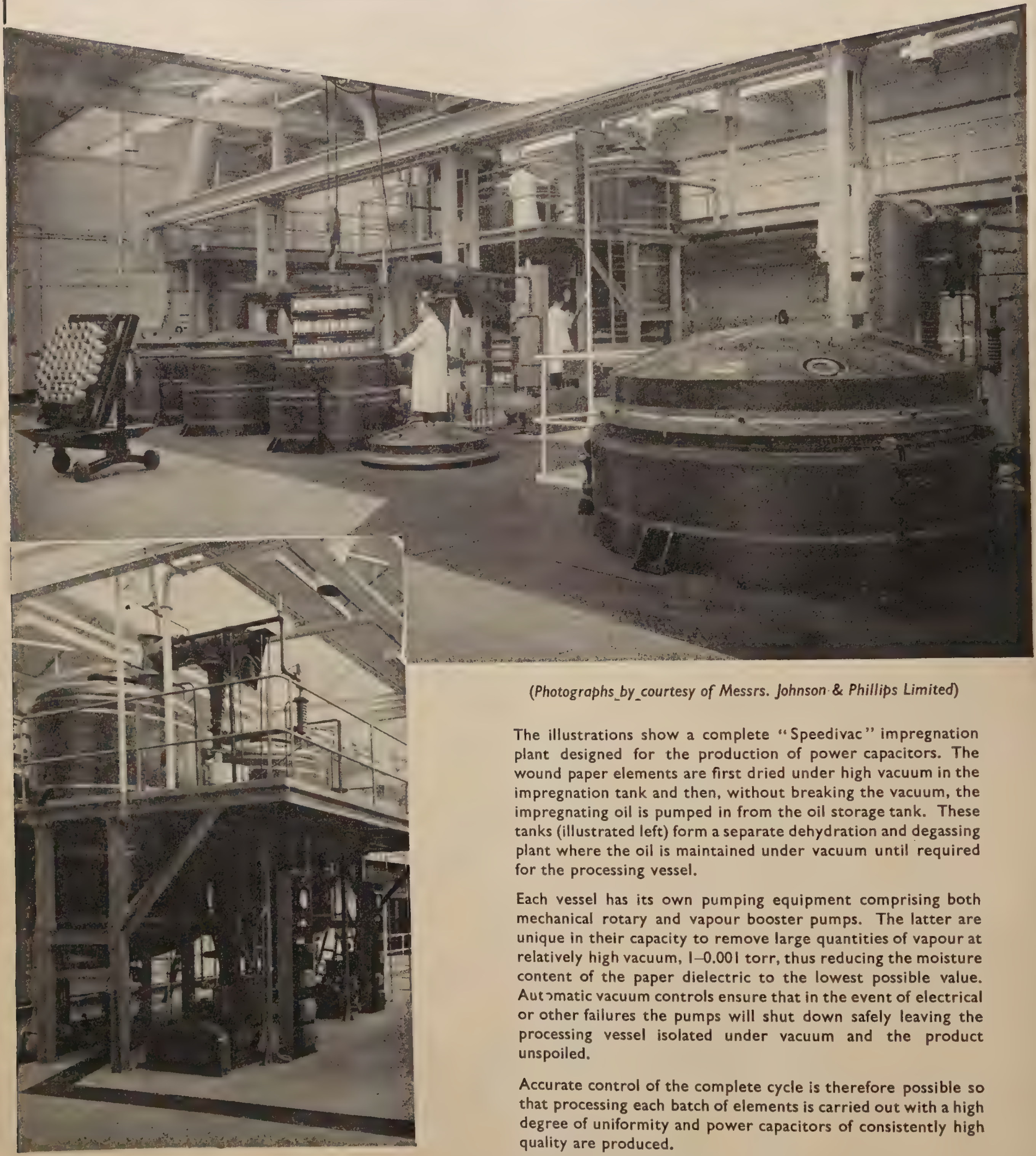

(Photographs by courtesy of Messrs. Johnson & Phillips Limited)

The illustrations show a complete "Speedivac" impregnation plant designed for the production of power capacitors. The wound paper elements are first dried under high vacuum in the impregnation tank and then, without breaking the vacuum, the impregnating oil is pumped in from the oil storage tank. These tanks (illustrated left) form a separate dehydration and degassing plant where the oil is maintained under vacuum until required for the processing vessel.

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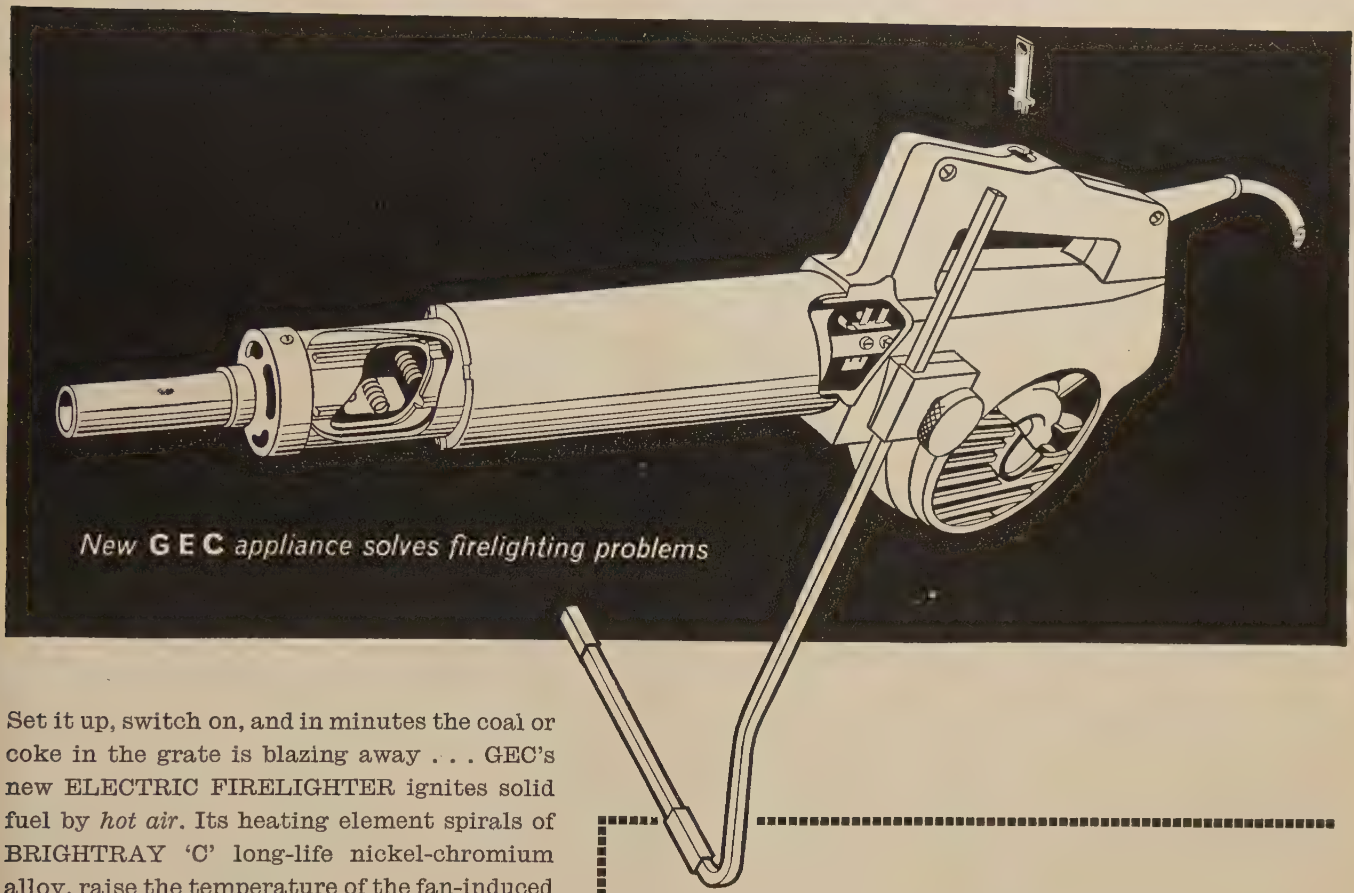

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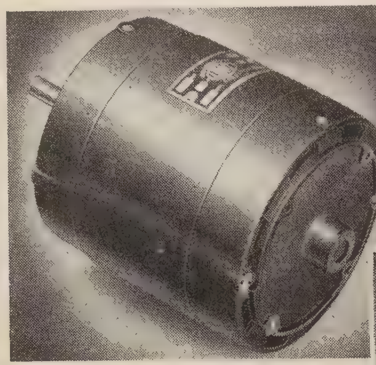
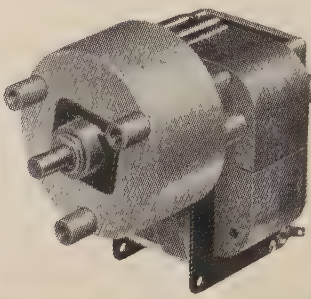
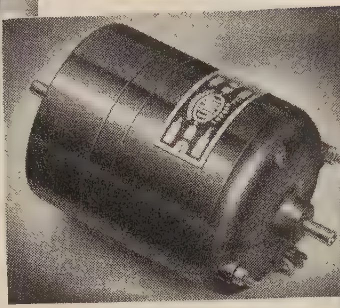
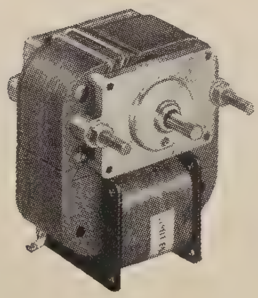
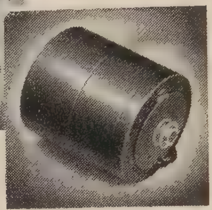
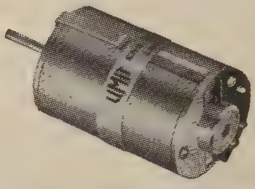

Shaded Pole


Shaded Pole
Skeleton Frame
Geared Units


Capacitor


Shaded Pole
Skeleton Frame


D.C.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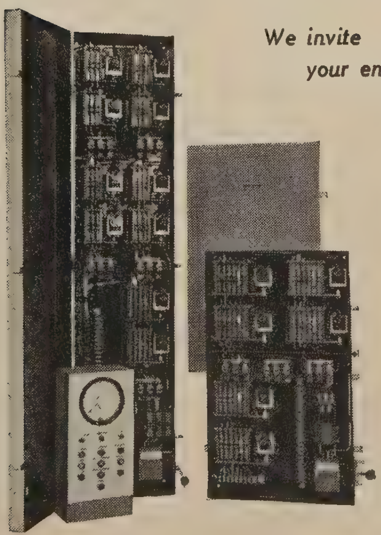

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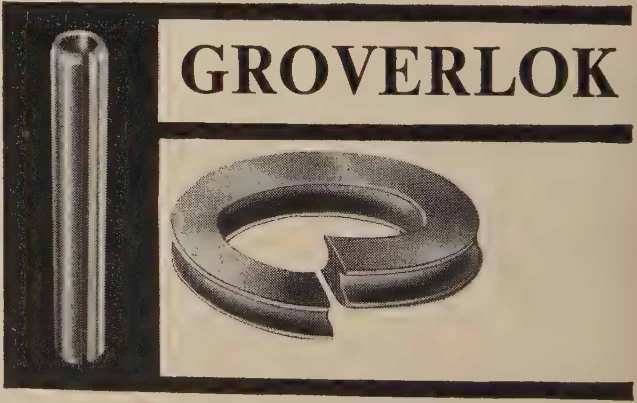

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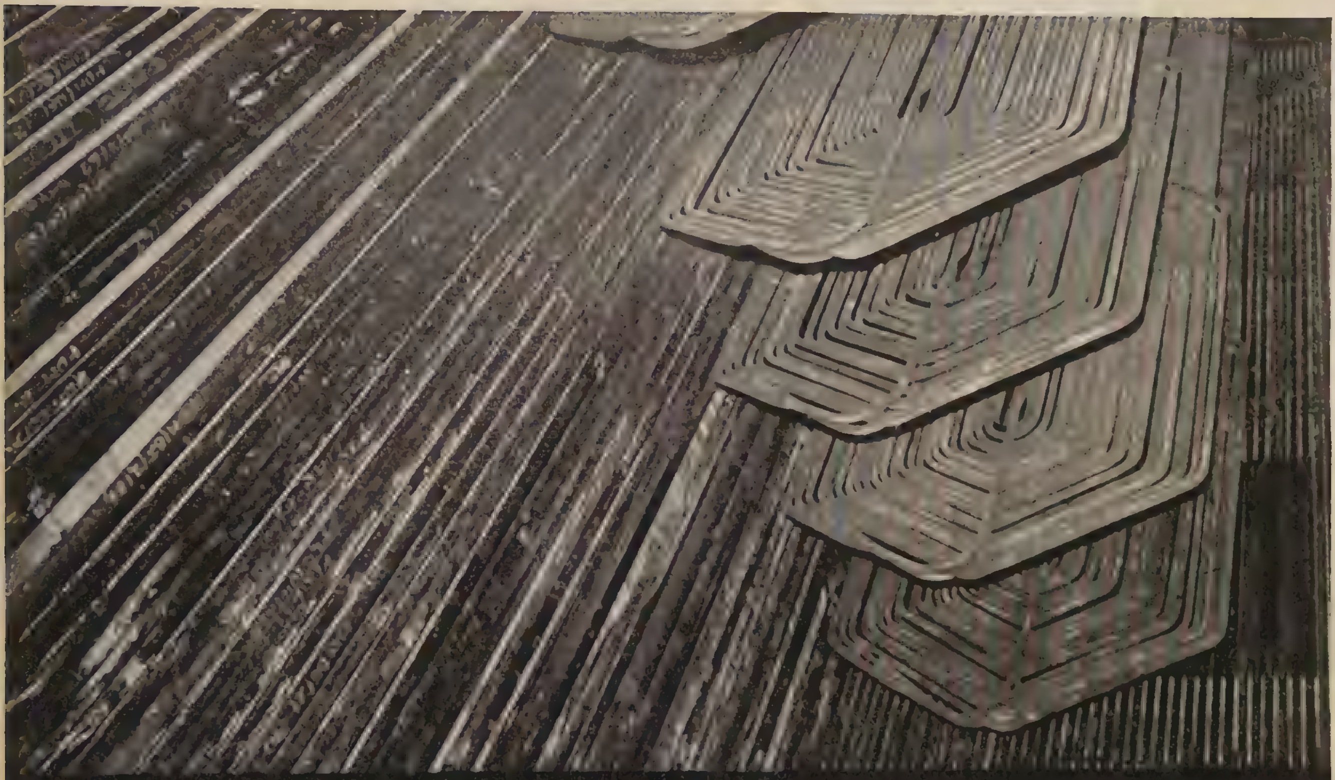
Tubes for power at Padiham



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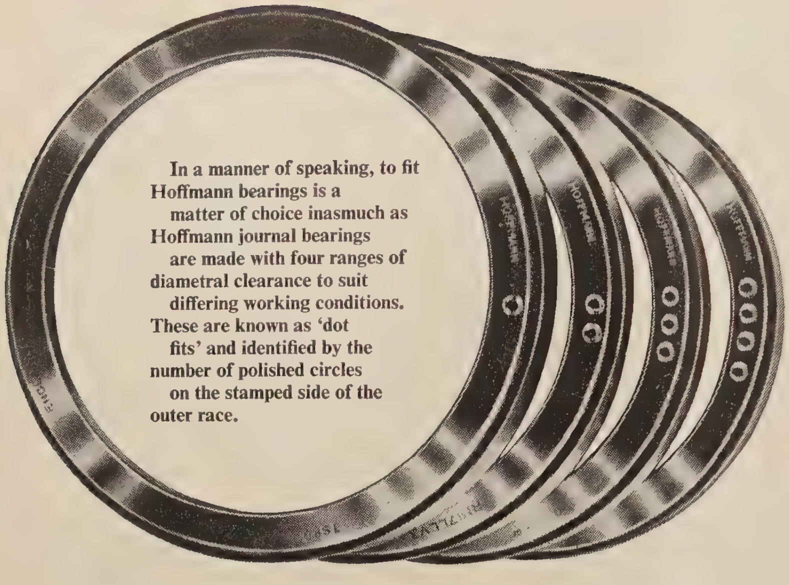

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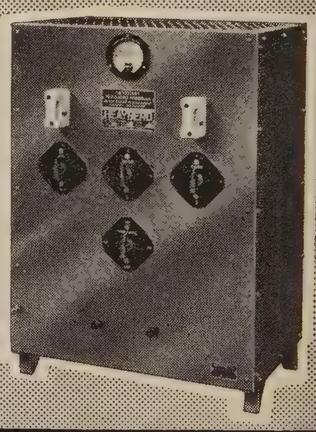

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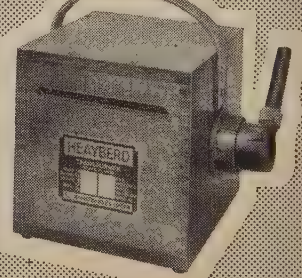

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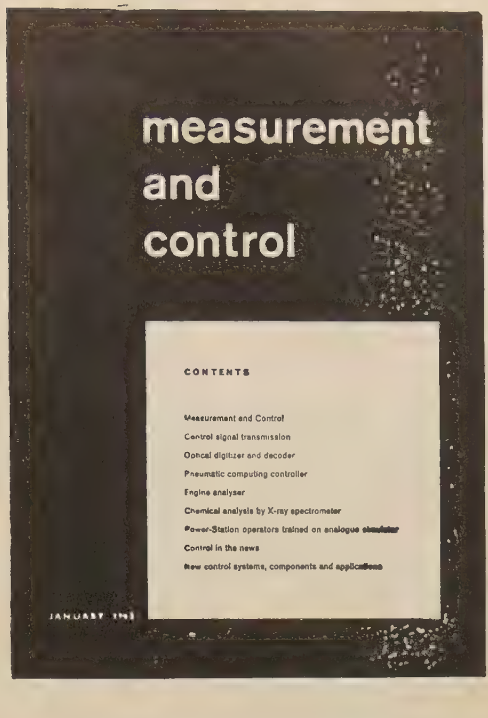

measurement and control

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Control signal transmission
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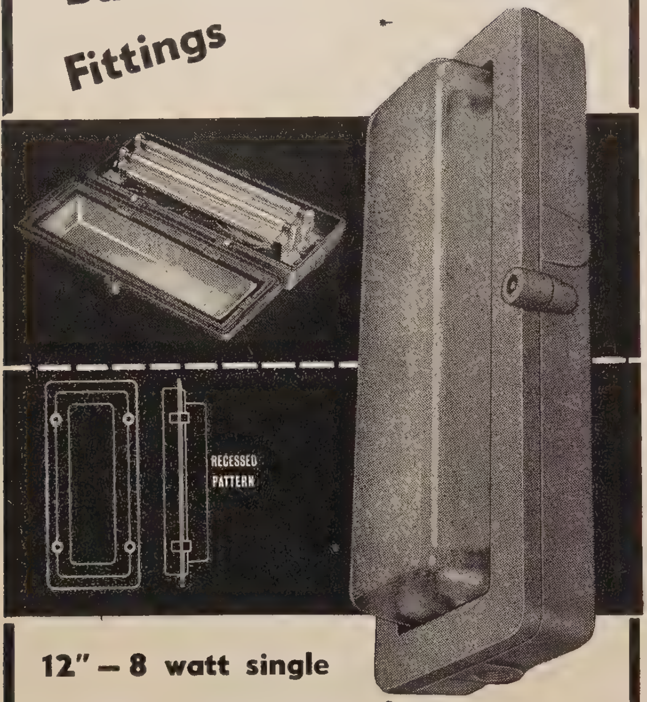

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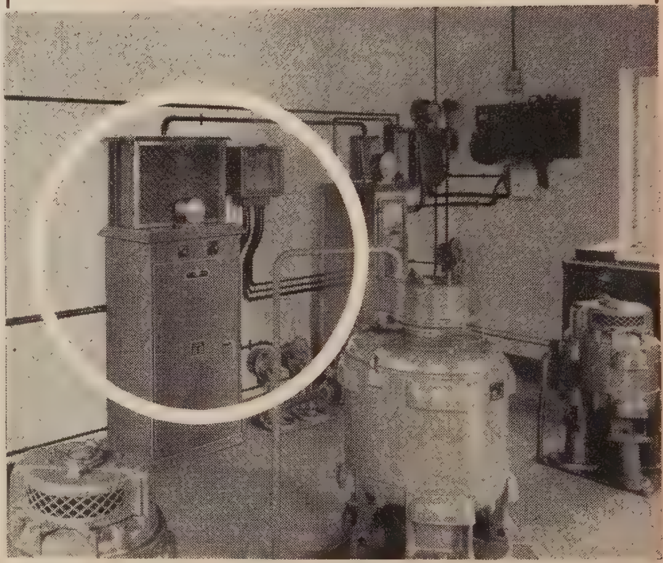

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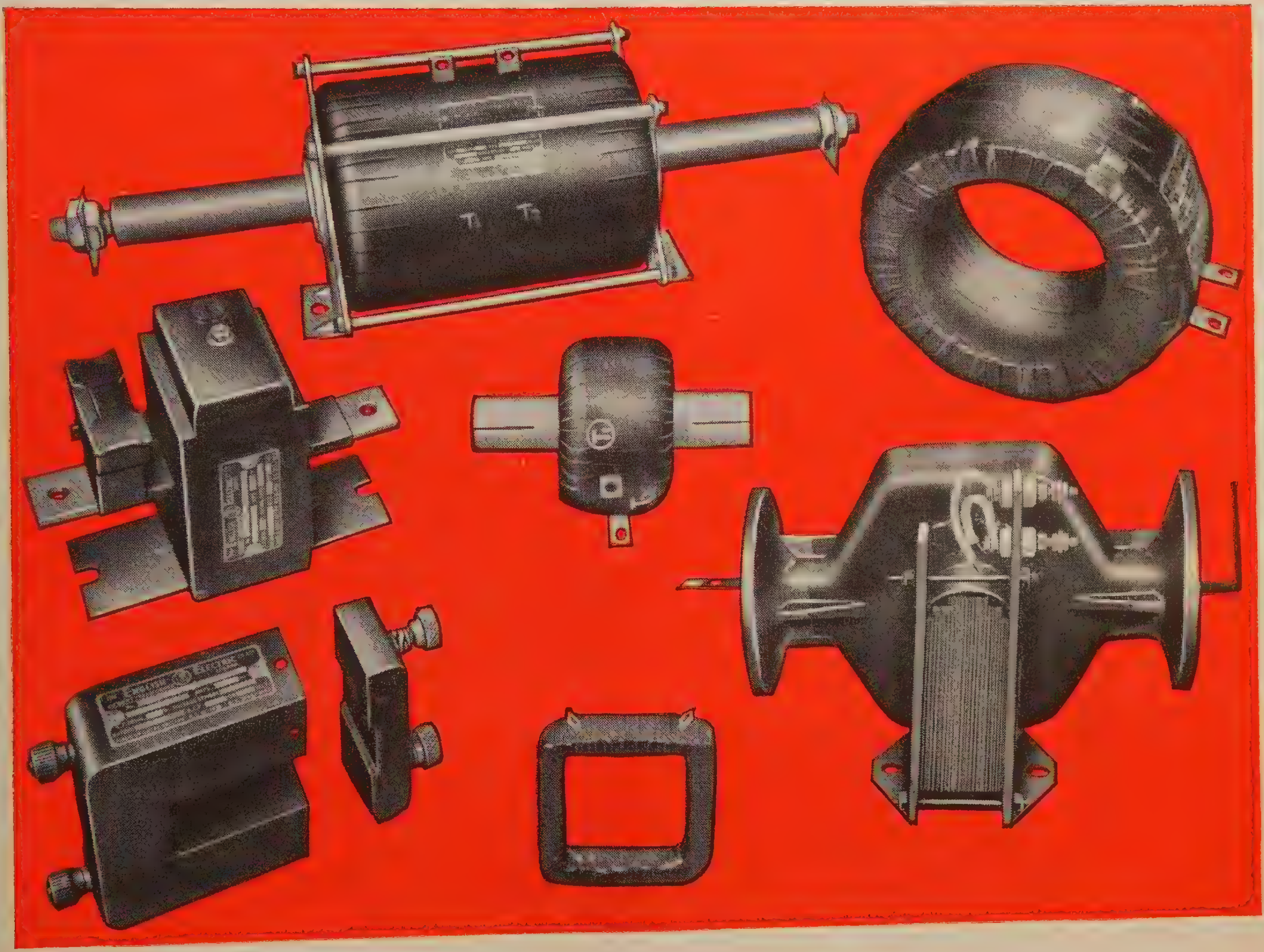

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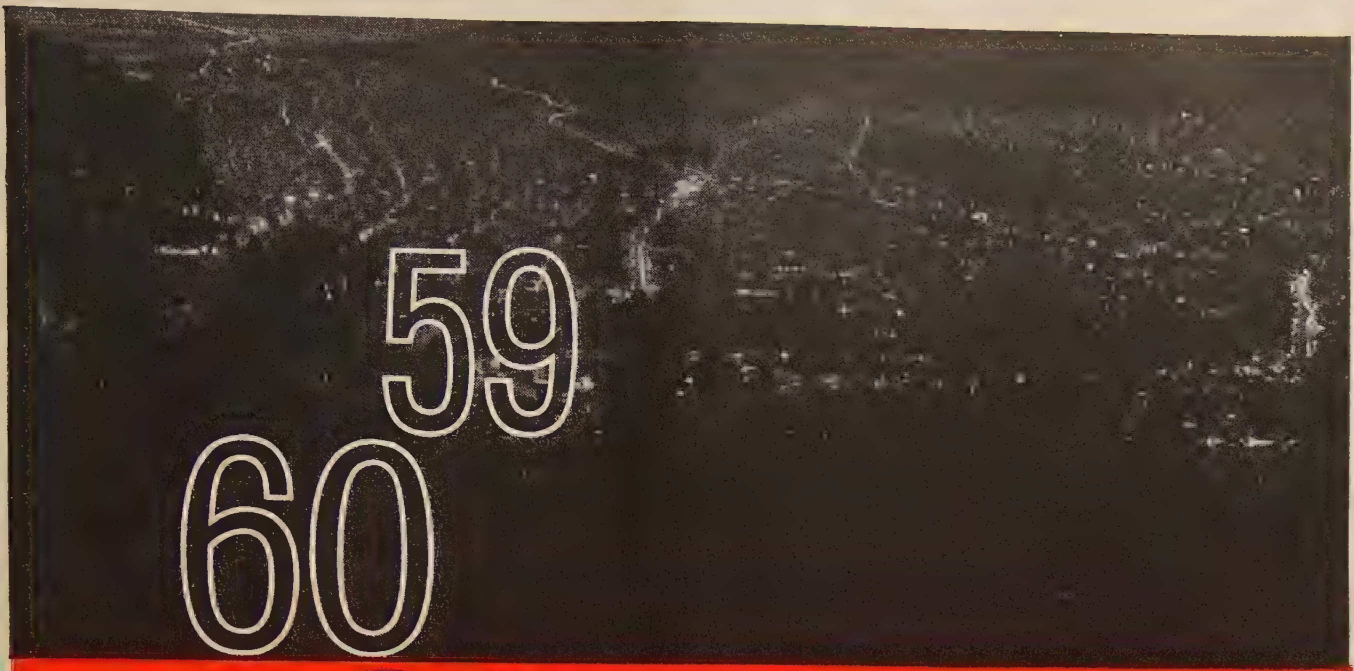

61

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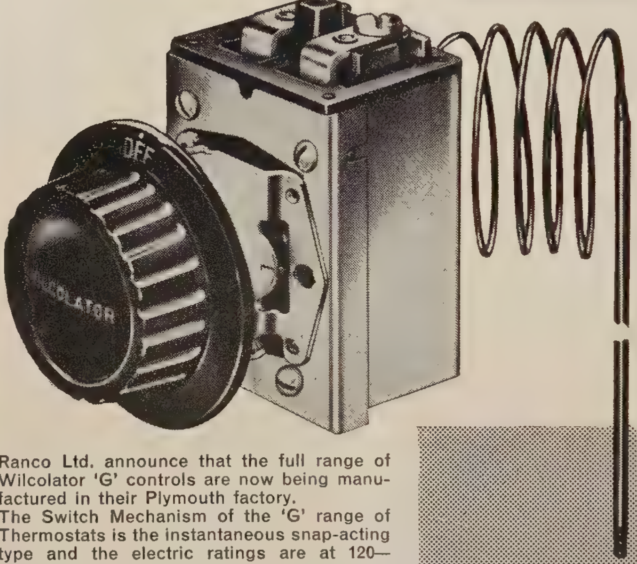

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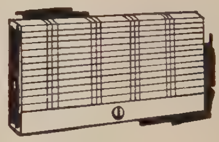

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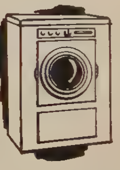

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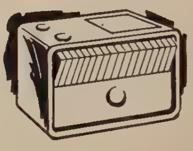

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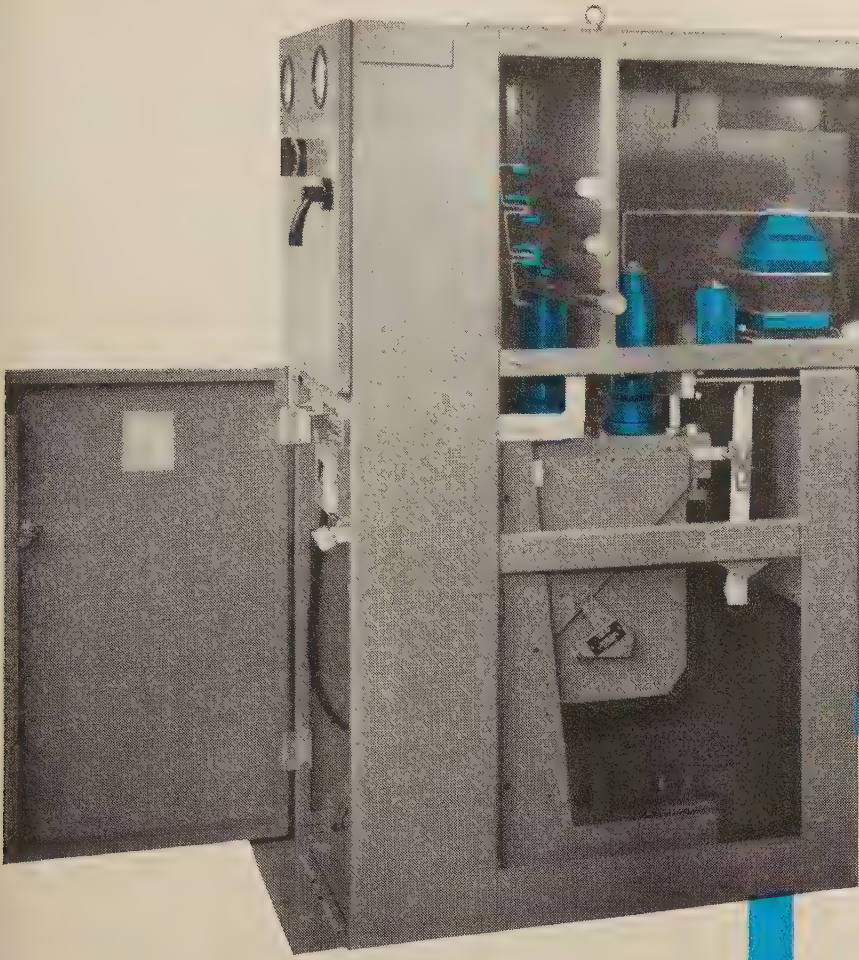

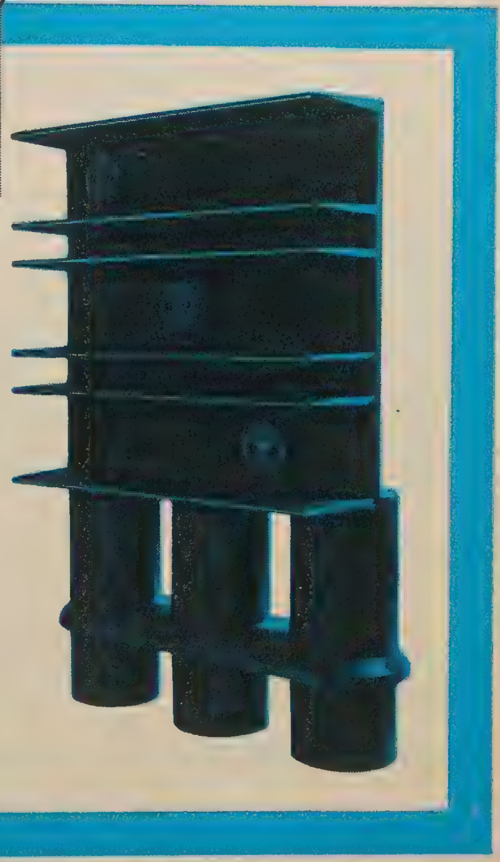

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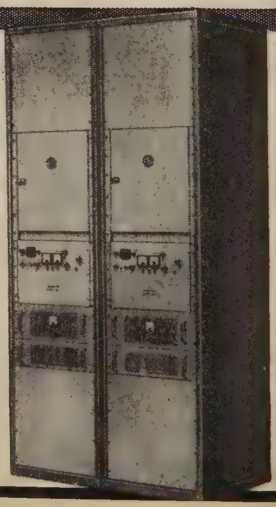

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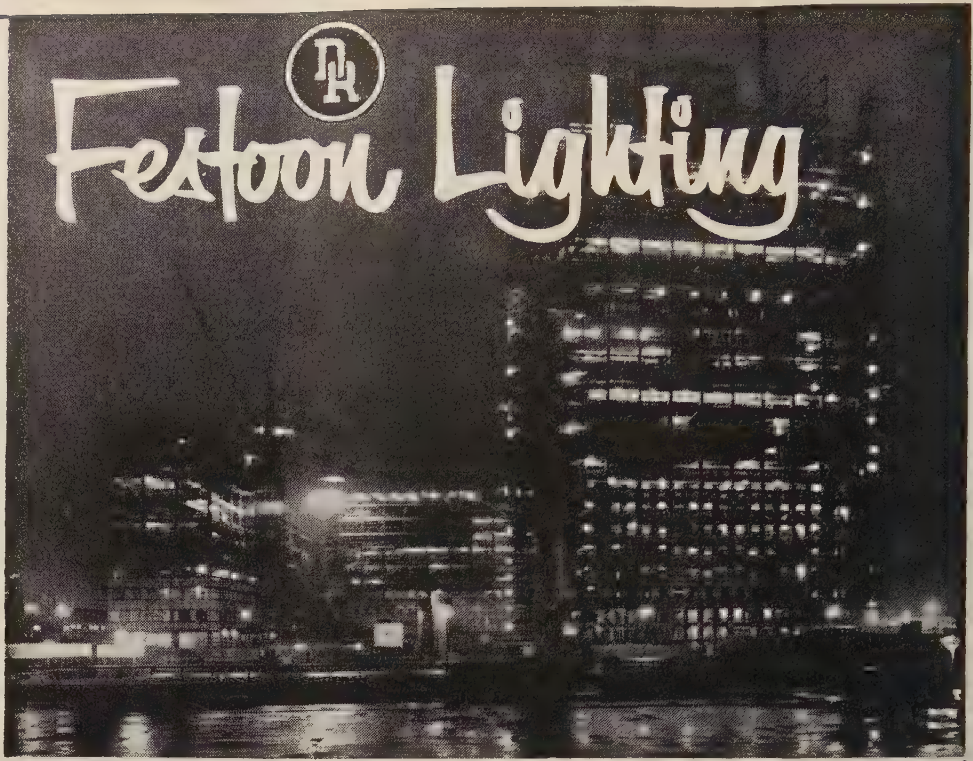

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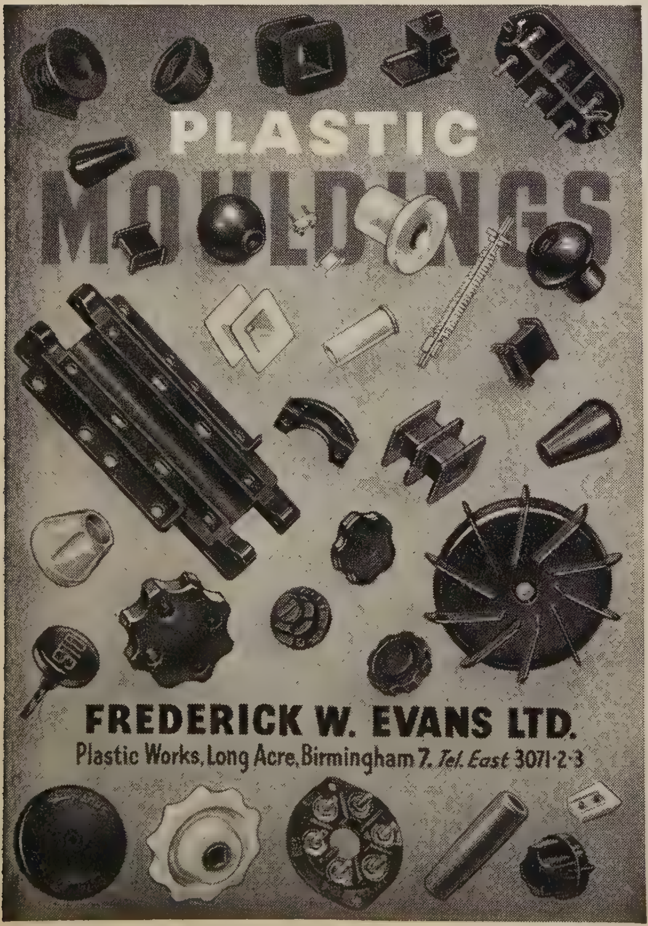
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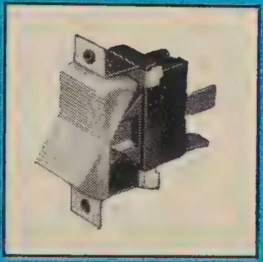

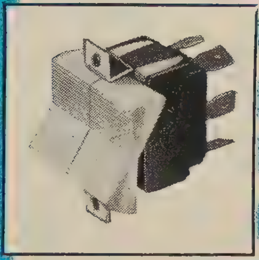

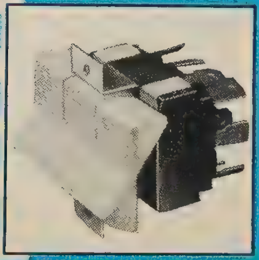

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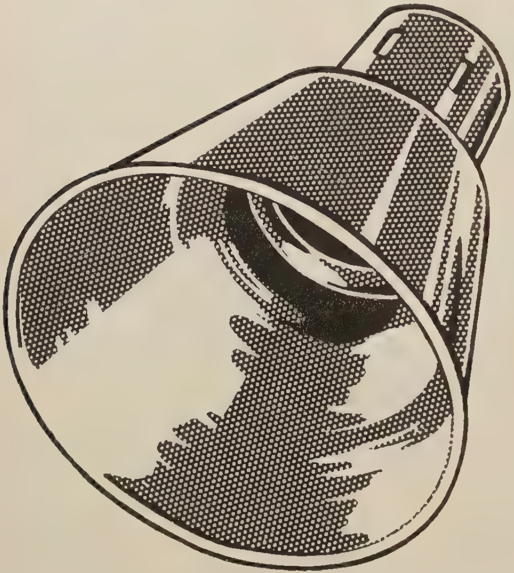

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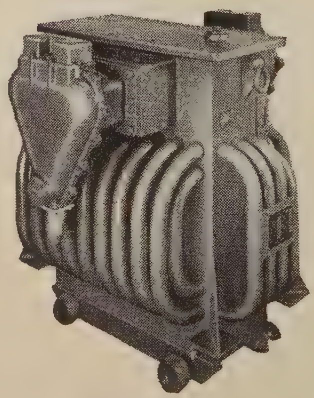

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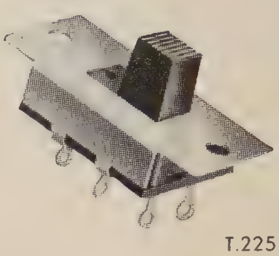

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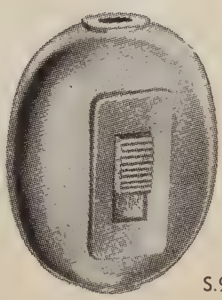
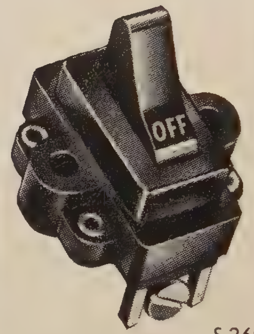


S.952



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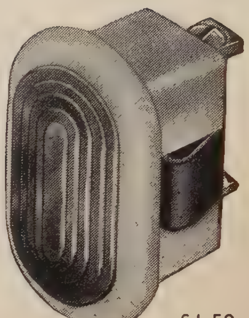

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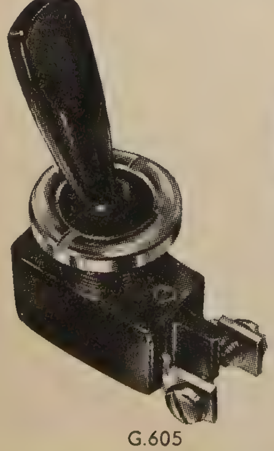
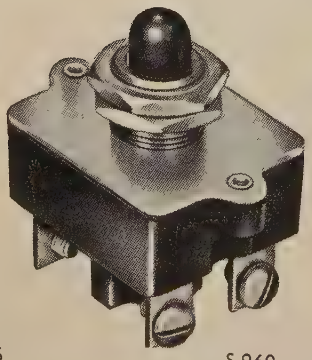


G.605

A.56



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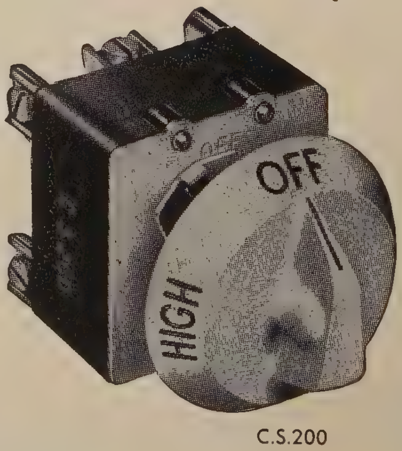

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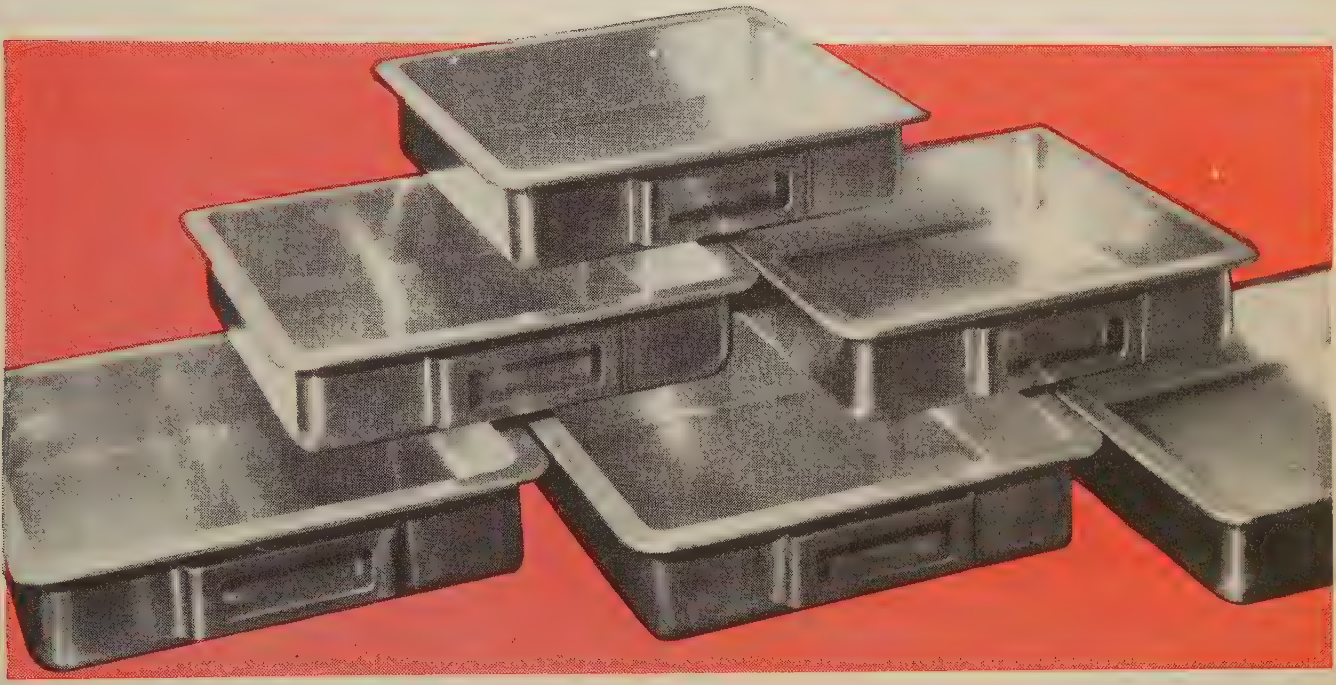

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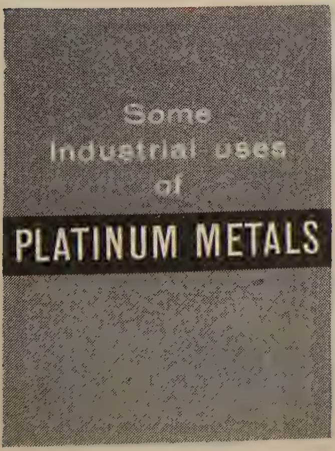

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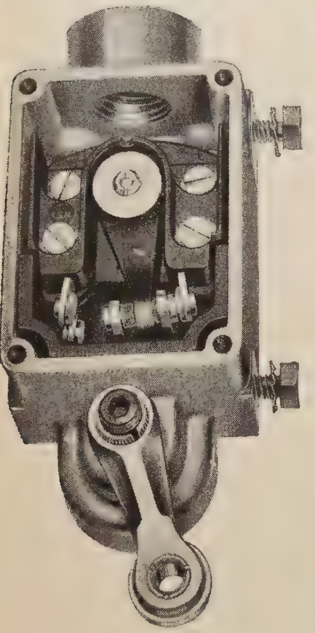

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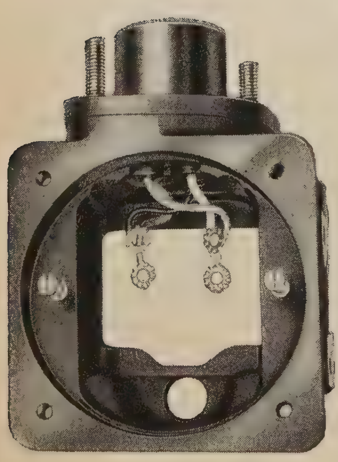
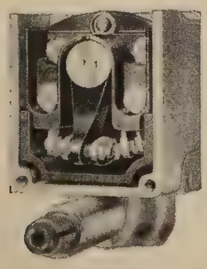


The mechanism of the Flameproof switch is easily removable as a unit for servicing.



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Standard Neutral position or Centre connection

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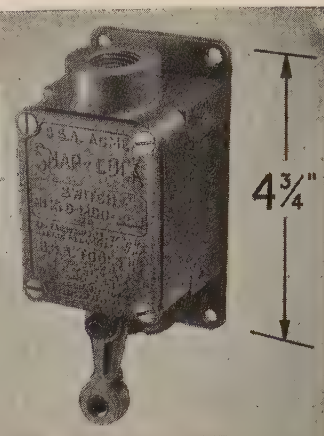
SNAP-LOCK
ACME



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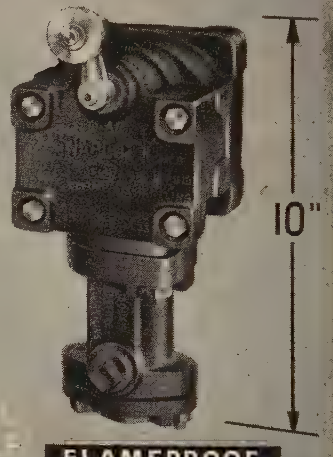

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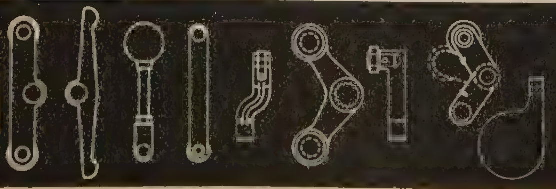

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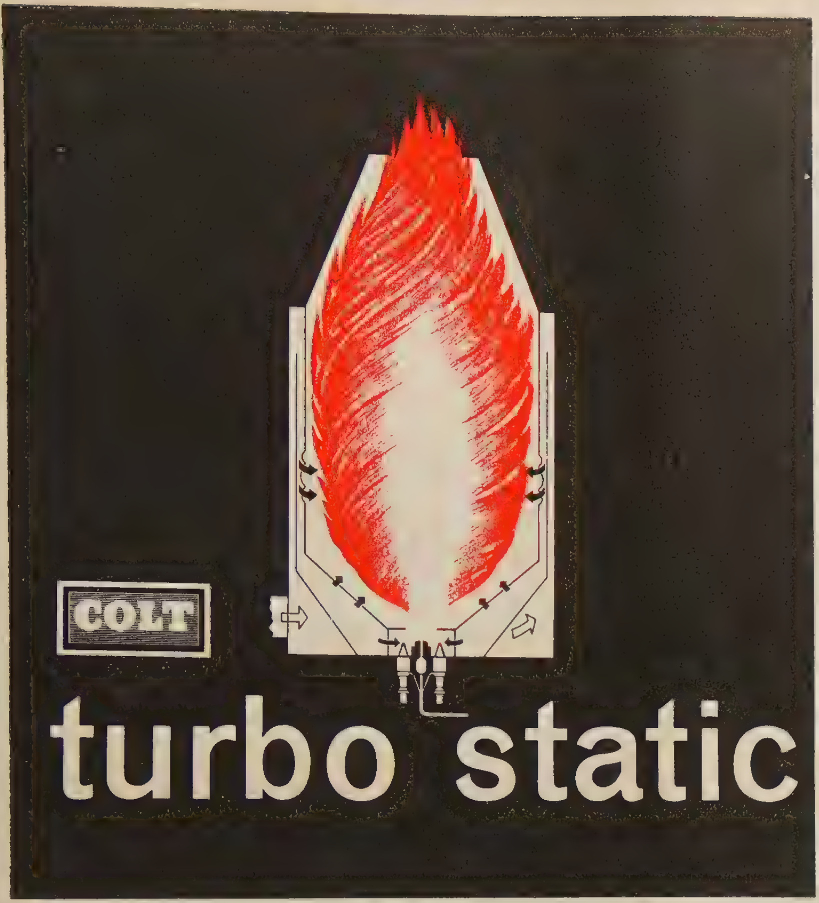

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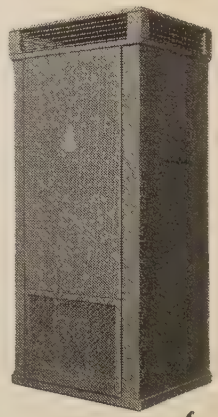

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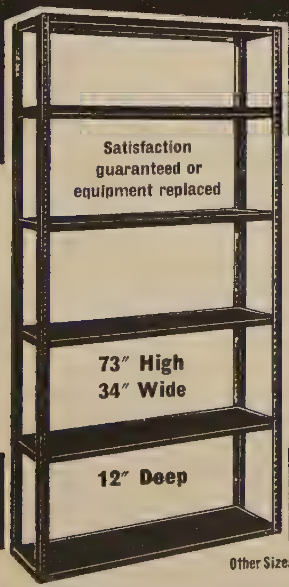
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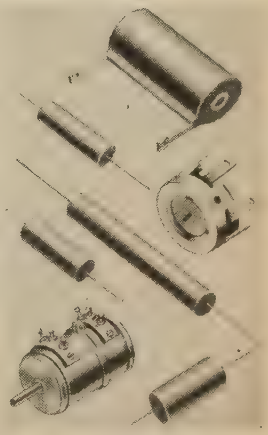

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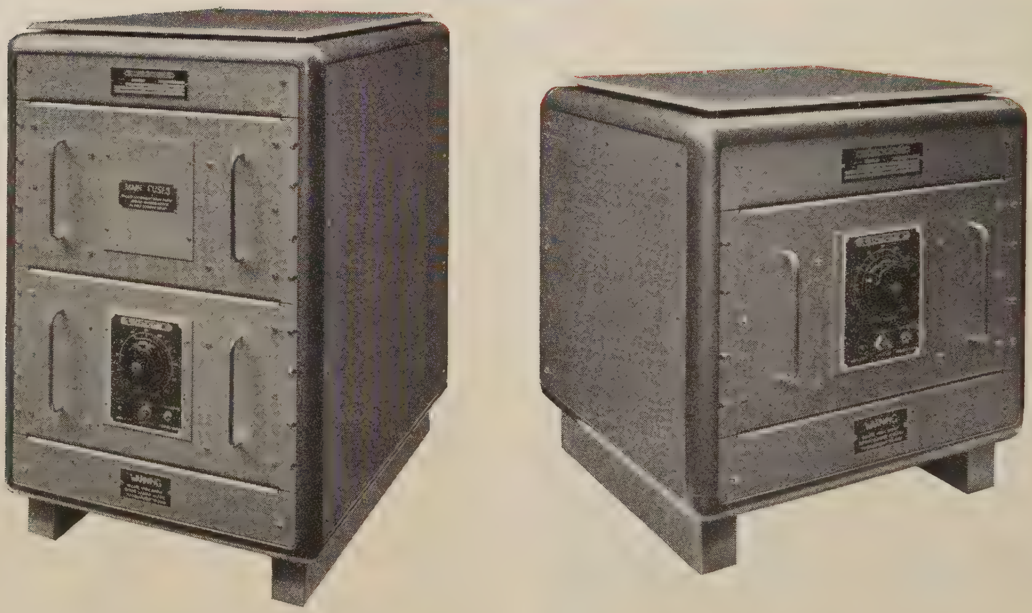

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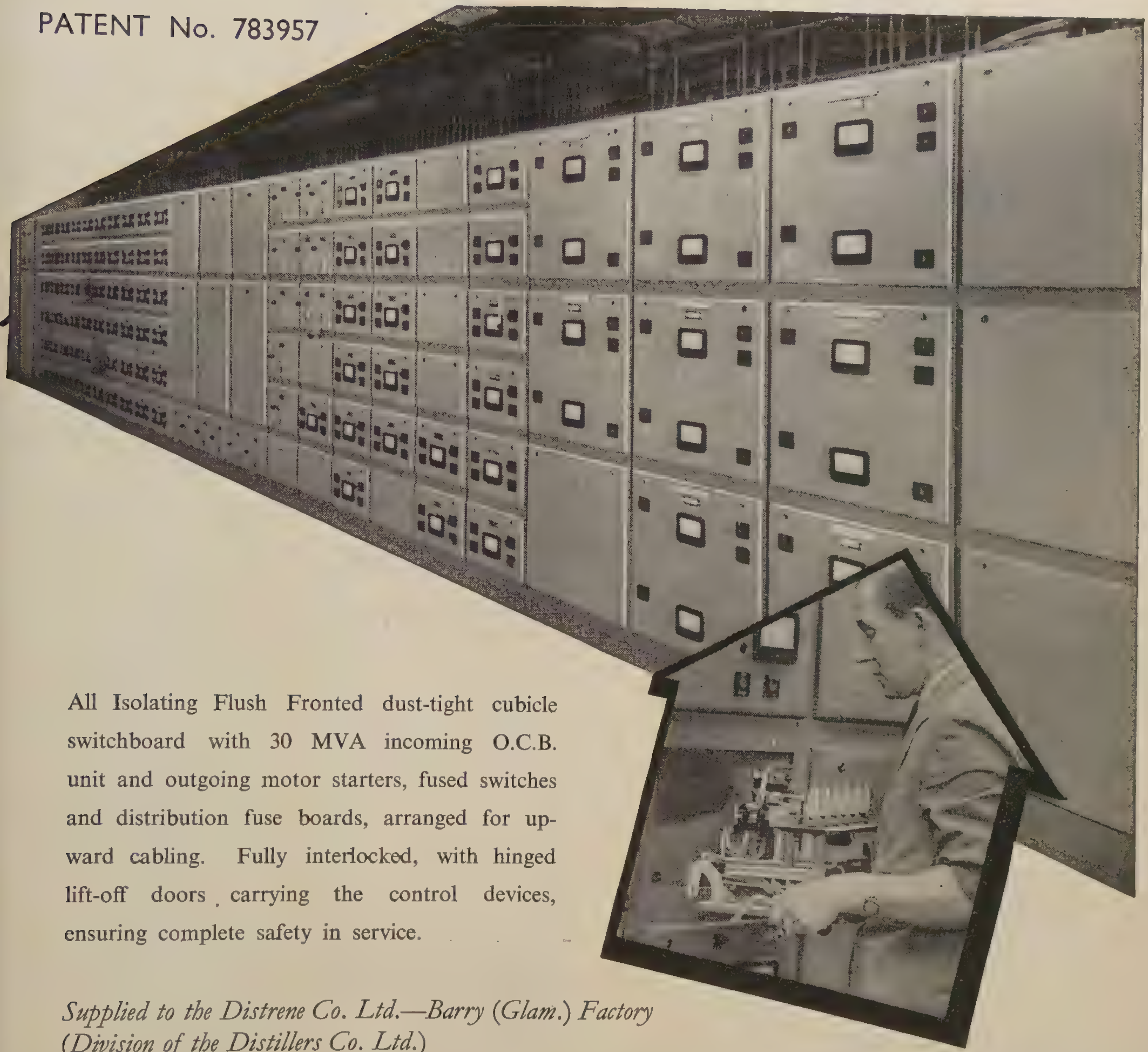

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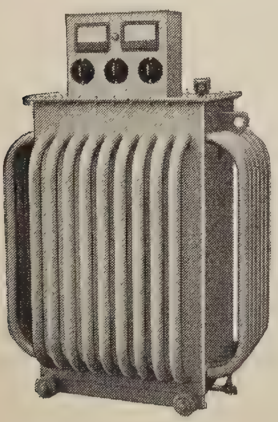

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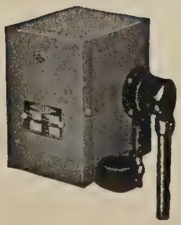

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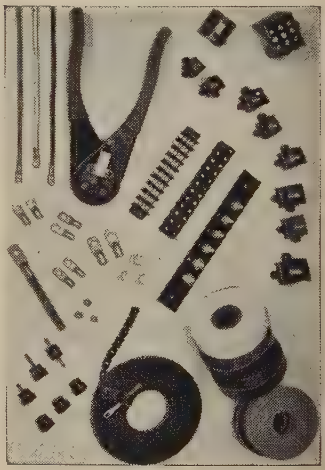

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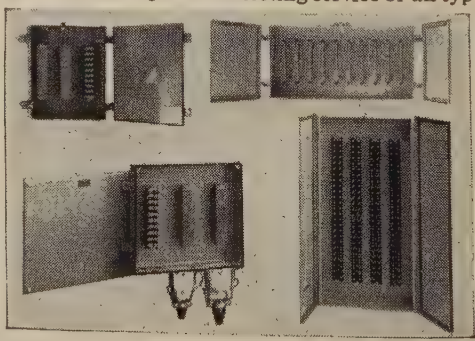

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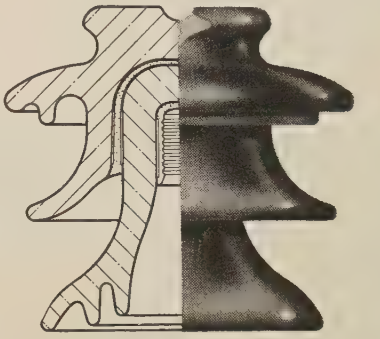

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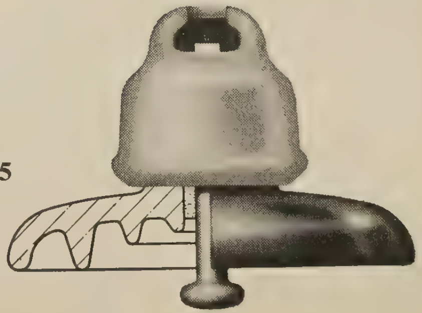

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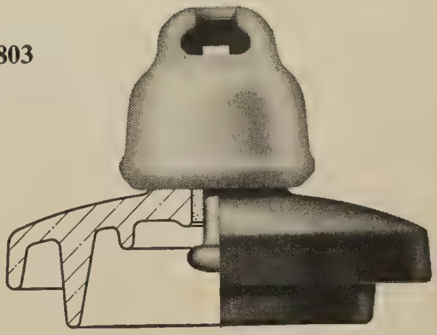

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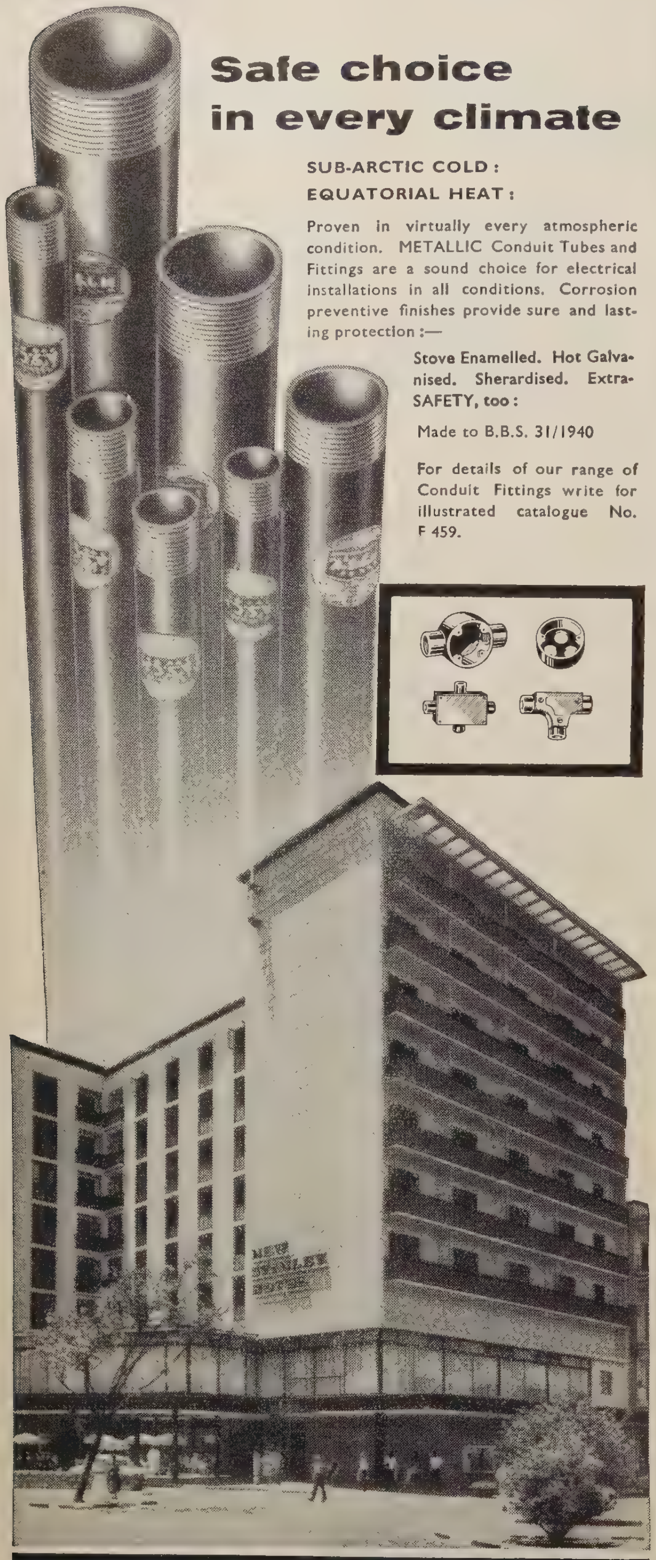

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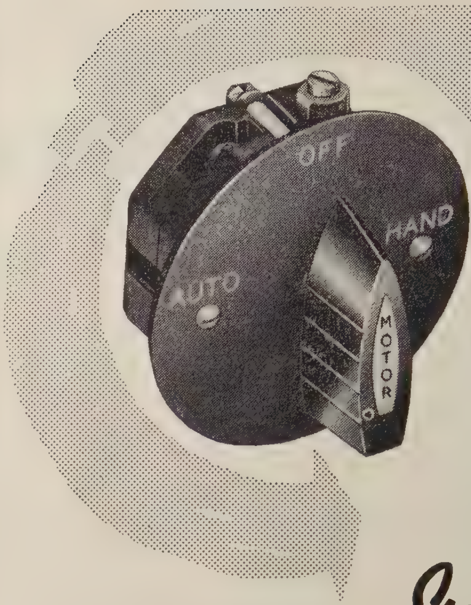

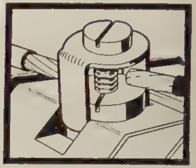

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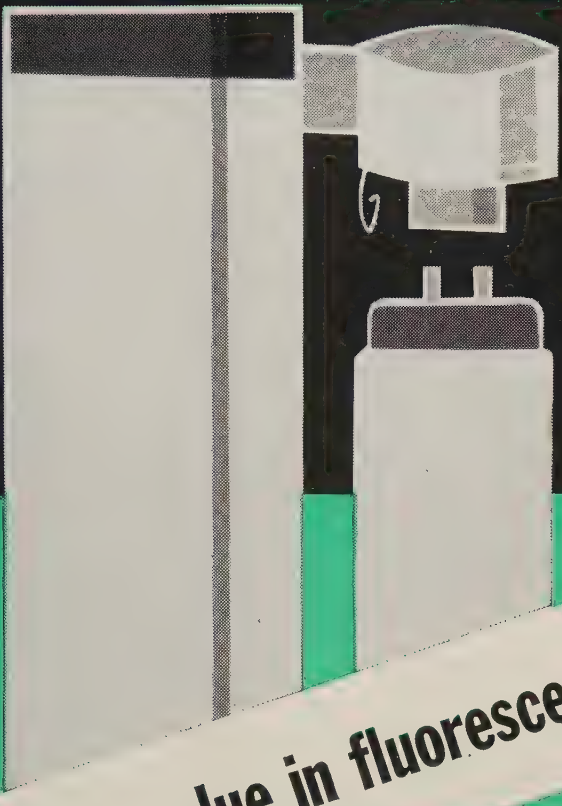

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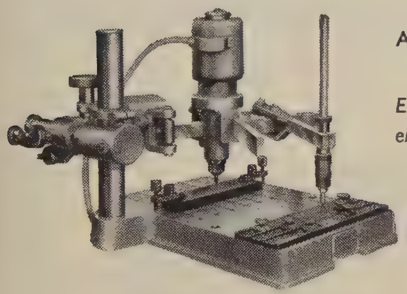

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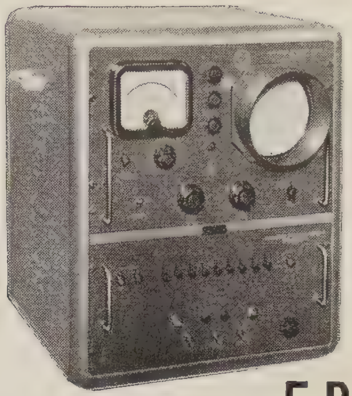

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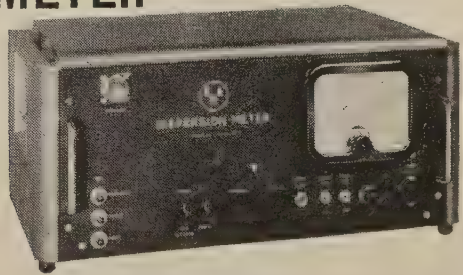

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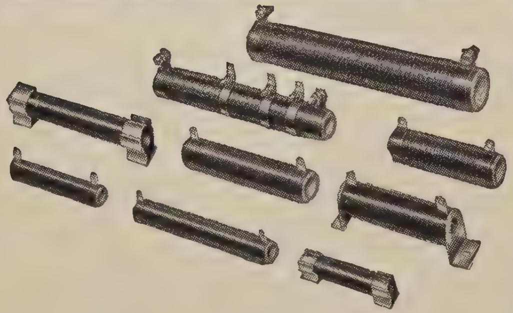

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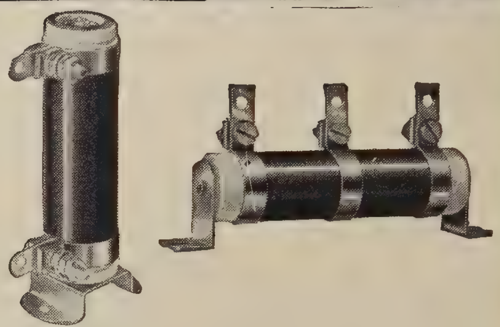

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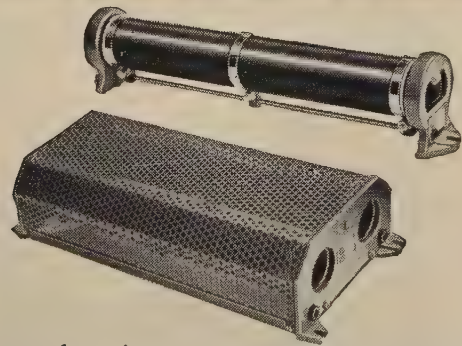

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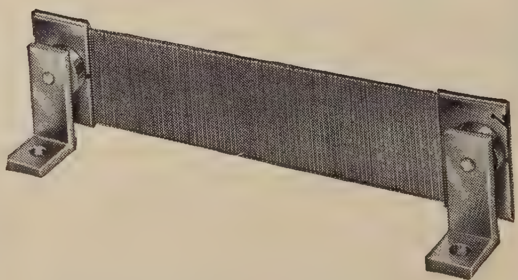

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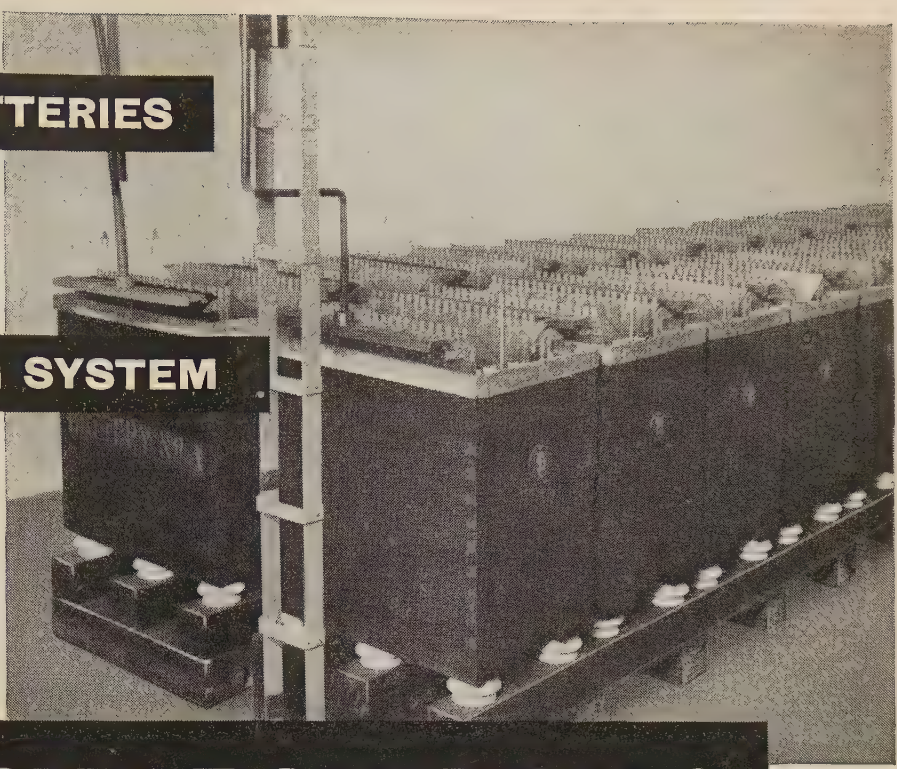


TUNGSTONE BATTERIES

are playing their part in the latest development in the Telephone System of this country, viz:—

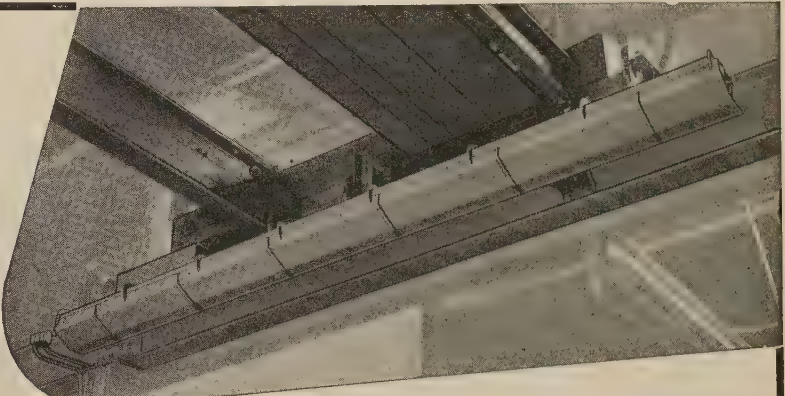
TRUNK DIALLING SYSTEM

Tungstone Products Limited are privileged to have installed their Batteries in the majority of "Satellite" Exchanges in the first area selected by H.M. Postmaster General for this great step forward in the history of the Telephone Service.

TUNGSTONE BATTERIES

TUNGSTONE PRODUCTS LIMITED, 10 SALISBURY SQUARE, LONDON, E.C.4
Works: MARKET HARBOROUGH, LEICS.

TC22A



A NEW NAME MEANING COMPLETE SAFETY IN POWER SUPPLIES TO TRAVELLING CRANES

Manguard

SAFETY SUPPLY SYSTEM
(Prov. Patent No. 31568/58)

PRINCIPLE

The principle of Manguard is the provision of a set of flexible bar collectors on the crane and electrically protected contact boxes at intervals along the crane track connected by insulated cable.

SAFETY FEATURES

- Contact box spacing ensures an electrical supply to the crane at all times.
- Each contact box has its own contactor ensuring that the contact studs are alive only when in contact with the crane collector bars.
- The crane collector box is fabricated in fibreglass. The four contact bars are bedded in flexible polyurethane, giving long life and minimum maintenance.
- Isolation of any section may be readily carried out.
- MANGUARD equipment may be fitted to existing cranes.

DE BERGUE MACHINE TOOLS LIMITED
WEST GORTON, MANCHESTER 12
TELEPHONE: EAST 2771 (6 LINES)
TELEGRAMS: DEBERGUE, MANCHESTER

WE'D ENJOY MOULDING PLASTICS FOR YOU

Osma Industrial Mouldings have a high strength/weight ratio, will neither rust nor corrode and are unaffected by weather. They resist a wide range of chemicals including weak acids, alkalis, organic solvents, oils, fuels and inorganic solutions. Their mechanical properties are good and they are an electrical insulator. They resist abrasion and are through coloured.

Any particular property can often be enhanced if required.

In our Factory at Hayes, we have a battery of presses capable of producing mouldings from 0.32 square inches to 32 square feet.

They are used to mass-produce reinforced plastics and D.M.C. mouldings in all manner of shapes for Industrial purposes. Small intricate mouldings or components with large surface areas can both be made to fine tolerances.

Our interest is primarily in polyester-glass fibre and because we employ experts we know, perhaps more than anyone else, the possibilities and limitations of the material.

This specialised knowledge is available to industry in general, and in particular to manufacturers of electrical and mechanical equipment.

What can we make for you? Can our product help yours? The materials you are now using may appear to be the best, but in a surprising number of cases OSMA polyester-glass fibre will prove even better.

The full strength of our technical advisory service, and of our design, development and mass-production facilities could be yours.

Arrange to meet us. We shall not keep you for longer than we can hold your interest.

OSMA PLASTICS LIMITED

Grove House 551 London Road Isleworth Middlesex
Telephone: Isleworth 7261 Telegrams: Osma Hounslow

todays
top
seller

now reduced in price!

EKCO SUPER SLIM

POPULAR PACK – *complete with tube*

Range of reflectors
and diffusers available
and easily attached

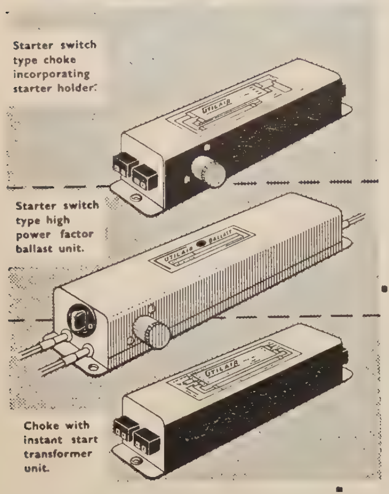
		Switchstart	Slickstart
8 ft.	— 125W —	£7. 2. 0	—
5 ft.	— 80W —	£4. 11. 6	£4. 16. 0
4 ft.	— 40W —	£3. 14. 7	£3. 19. 0
2 ft.	— 20W —	£2. 16. 0	—

All prices
include tube
P.T. & 10% surcharge

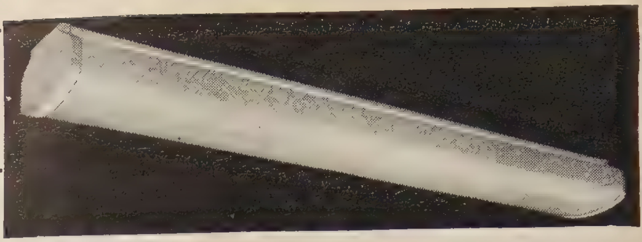
EKCO-ENSIGN ELECTRIC LTD.
45 Essex Street, Strand, London W.C.2. Tel: CITy 8951
LONDON · MANCHESTER · BIRMINGHAM · NOTTINGHAM · GLASGOW · CARDIFF

UTILAIR

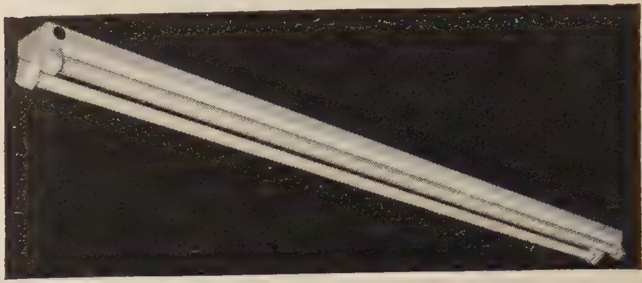
BRITAIN'S BEST FLUORESCENT LIGHTING FITTINGS & CONTROL GEAR


Starter switch type choke incorporating starter holder.
Starter switch type high power factor ballast unit.
Choke with instant start transformer unit.
UTILAIR

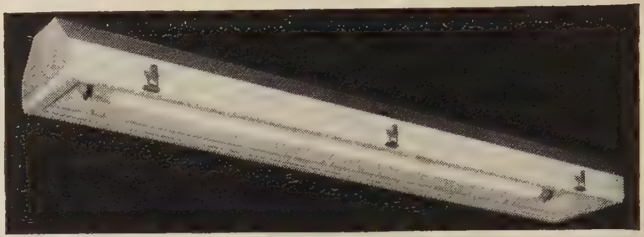
Britain's best range of Fluorescent Fittings selected for efficient lighting by famous concerns all over the world



Model EP.802 Suspended or ceiling fitting with opal fluted diffusing cover



Model D.2125 Twin 8ft 125 watt batten fitting

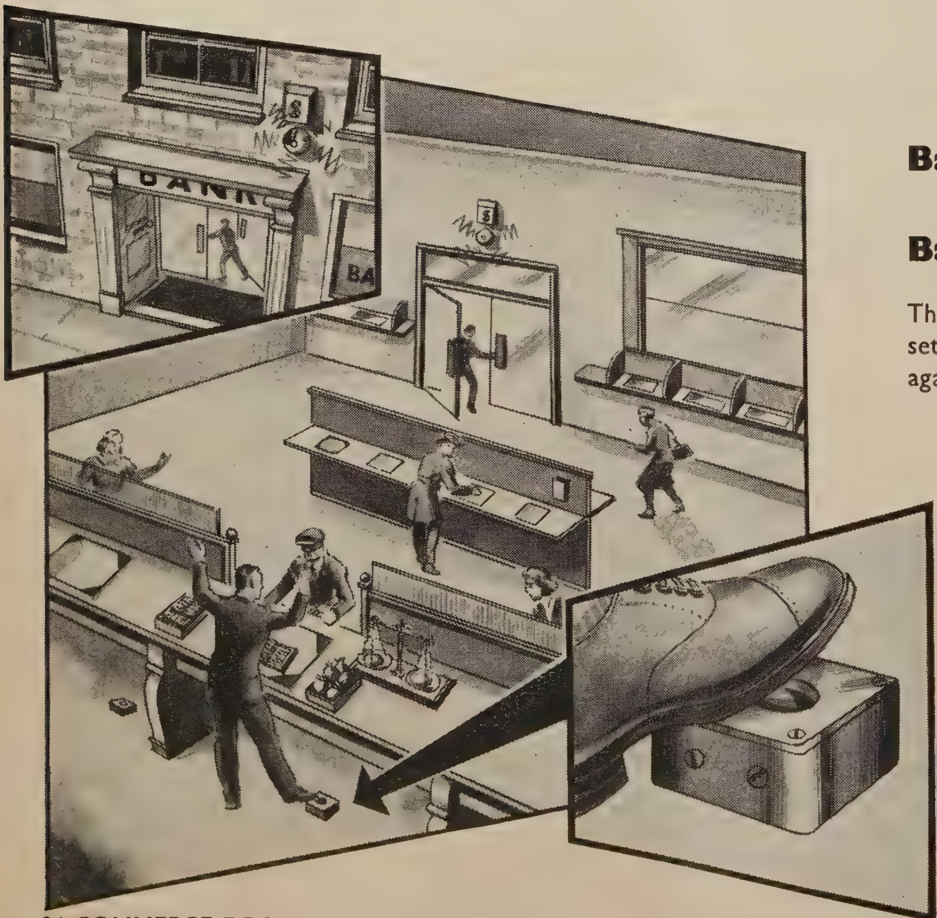


Model VP.802 Industrial vapour-proof totally enclosed fitting

UTILITIES (LONDON) LTD.

Manufacturing Electrical Engineers

TUNSTALL ROAD • BRIXTON
LONDON • S·W·9
Telephone : Brixton 6811-4 *Telegrams : Utilon, London, S.W.9*



SAX

Bandit Alarm Systems For Banks, Post Offices, etc.

This reliable installation of Alarm Bells set off by Foot contact is effective against the hold-up bandit.

★

Full details of SAX bells, Relays, Foot Contacts, etc. and Diagrammatic Layout to suit particular requirements, supplied on request.

JULIUS SAX & CO. LTD.

24 COMMERCE ROAD, BRENTFORD, MIDDX.

Established in 1855

Telephone: ISLeworth 6034/5

G.F.C.9

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 4/- per line (approx. 6 words).

DISPLAYED CLASSIFIED:—53/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%; 26, 10%; 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Remittances payable to "ELECTRICAL REVIEW."

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual, instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

Advertisements are accepted up to **first post on Monday** of the week of issue

If blocks, bold type or ruled borders are required then on **Friday** prior to week of issue

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF WORKSOP

Street Lighting

TENDERS are invited from bona fide contractors for the removal of existing street lighting standards and for the supply, erection and servicing of the undermentioned street lighting units:—

217 Sodium Lanterns, 60 watts, mounted on 15-ft. concrete columns.

Tenderers may quote for:—

1. Supplying only the lanterns, auxiliary equipment and lamps; or
2. The removal of existing lighting units and the supply of new standards together with the wiring and fitting of all equipment; or
3. The whole of the work required.

Copies of the specification, bills of quantities and forms of tender may be obtained from the Borough Engineer, Park House, Worksop, upon payment of a deposit of £3 3s., which will be reimbursed upon the receipt of a bona fide tender.

Tenders in sealed envelopes, endorsed "Street Lighting," must reach the undersigned not later than 10 a.m. on Monday, 27th November, 1961.

The lowest or any tender will not necessarily be accepted.

RUSSELL C. PHARAOH,
Town Clerk.

Town Hall, Worksop.
27th October, 1961.

2856

PETERBOROUGH RURAL DISTRICT COUNCIL

Mobile Alternator Unit

THE above Council invite tenders for the supply of a Mobile Alternator Unit for emergency use at their sewage pumping stations.

Specification and tender form can be obtained from the Council's Surveyor (Mr. M. R. Gibbs) at 51, Priestgate, Peterborough, and completed tender form should be delivered to the undersigned in the envelope provided not later than 10 a.m. on Tuesday, 5th December, 1961.

G. W. WRIGHT,
Clerk of the Council.

51, Priestgate,
Peterborough.
1st November, 1961.

2885

CITY OF MANCHESTER

Hadfield Overspill Site: Street Lighting Equipment

TENDERS are invited for the supply of the undermentioned items:—

64 G.E.C. 25569B Top Entry Lanterns.
93 Solid Filled Chokes suitable for 80-watt H.P.M.V. lamps.
93 Oil-filled Capacitors, 13 m.f.d.
93 Sangamo Weston Time Switches, type S.251.

Tender forms, returnable by 24th November, 1961, from City Surveyor, Town Hall, Manchester, 2.

2879

FEDERATION OF RHODESIA AND NYASALAND FEDERAL POWER BOARD KARIBA HYDRO-ELECTRIC SCHEME

FIXED TO FIXED RADIO COMMUNICATIONS EQUIPMENT

The Federal Power Board proposes to call for tenders for the supply, delivery and erection of fixed VHF/UHF radio equipment for communication between Norton and Salisbury in Southern Rhodesia, a distance of about 19 miles.

The equipment is required initially to provide two channels in each direction for the transmission of coded intertripping (transferred trip) signals, and reliable telephone communication between the Board's sub-stations at Norton and Salisbury.

Contractors wishing to tender should submit details of their qualifications and experience by 1st December, 1961, after which tender documents and drawings will be issued to those organisations satisfying the Board's requirements.

Applications should be sent in duplicate to the Secretary, Federal Power Board, P.O. Box 630, Salisbury, Southern Rhodesia, with a separate copy direct to the Board's Consulting Electrical and Mechanical Engineers, Messrs. Merz and McLellan, Carliol House, Newcastle-upon-Tyne, 1, England.

2886

COUNTY BOROUGH OF IPSWICH

Improved Street Lighting, 1961/1962

TENDERS are invited for the erection of approximately 82 Group A Steel and Concrete Street Lighting Columns and the provision and erection of a similar quantity of 140-watt and 85-watt Sodium Discharge Lanterns with lamps and control gear.

Specification and bill of quantities may be obtained, and conditions of contract and layout drawings inspected, at the office of the Borough Engineer and Surveyor, 19, Tower Street, on payment of £1 1s. deposit, which will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Tenders, in plain sealed envelopes endorsed "Improved Street Lighting, 1961/62," must be received by the undersigned not later than noon on Monday, 27th November, 1961.

The Council do not bind themselves to accept the lowest or any tender.

J. C. NELSON,
Town Clerk.

Town Hall, Ipswich.
26th October, 1961.

2868

SITUATIONS VACANT

(See "Replies to Box Numbers" above)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

Third Assistant Engineer (Planning and Development), Area Headquarters, Dewar Place, Edinburgh

Salary N.J.B. Schedule A, Class L, Grade 10, Salary Scale No. 10, £1,190/£1,325 p.a.

APPLICATIONS, on the standard form, obtainable from the undersigned or any other Area Manager, should be submitted not later than 27th November, 1961.

Applicants for this superannuable appointment should have a sound engineering training and experience in the design and layout of densely loaded distribution networks in city areas and rural systems at pressures up to and including 33 kV; the application of modern protective equipment, and of the calculation and preparation of load flow diagrams and fault levels. Applicants must also possess as a minimum qualification a Higher National Certificate in Electrical Engineering or its equivalent.

Conditions of service will be in accordance with the National Joint Board Agreement for the Electricity Supply Industry. The successful candidate will require to reside within a reasonable distance of Area Headquarters.

C. H. A. COLLYNS,
Manager.

52, Melville Street,
Edinburgh, 3.

2890

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

Western Division

STATION CHEMIST (W/AV/109/61) required at Castle Meads Power Station, Gloucester.

Superannuation scheme. Salary N.J.B. Class E, Grade 7, Scale 7, £965-£1,090 per annum.

Candidates should preferably possess the H.N.C. in Chemistry or equivalent qualification and should be acquainted with the chemical services appropriate to a medium-pressure generating station. Supervision of the work and progress of trainee chemists will also be required.

STATION SHIFT CHARGE ENGINEER (W/AV/110/61) required at Castle Meads Generating Station, Gloucester.

Superannuation scheme. Salary N.J.B. Class E, Grade 7, Scale 7, £965-£1,090 p.a. plus 10% shift allowance.

Applicants should have had considerable experience in modern power station operation and preferably be graduate or corporate members of a recognised engineering institution or possess equivalent qualifications.

Previous applicants need not re-apply.

MAINTENANCE ENGINEER (Electrical) (W/AV/111/61) required at Portishead "B" Generating Station.

Superannuation scheme. Salary N.J.B. Class K, Grade 5, Scale 14, £1,535 - £1,720 per annum.

Applicants should have had wide experience in the maintenance of modern generating plant, and should preferably possess associate membership of an appropriate engineering institution or equivalent.

ASSISTANT ENGINEER (Instruments) (W/AV/112/61) required at Berkeley Nuclear Power Station.

Superannuation scheme. Salary N.J.B. Class M, Grade 12, Scale 9, £1,115 - £1,245 per annum.

Applications are invited for the above post from men with a thorough theoretical and practical knowledge of electronic equipment and its servicing.

The successful applicant will be engaged on high-grade servicing of all electronic and semiconductor devices associated with nuclear reactors. The duties will also include assisting in the training of instrument mechanics in the electronics field. Opportunities will be provided for gaining experience in conventional power station equipment.

Candidates should preferably be in possession of the H.N.C. (Elect.) or equivalent.

Applications for these appointments on form A.E.6/ACT, obtainable from the Personnel Department, 26, Oakfield Road, Bristol, 8, should be completed and returned by 22nd November, 1961.

2907

ESTABLISHED ELECTRICAL DISTRIBUTORS AND WHOLESALERS MANUFACTURING AND IMPORTING DIRECT ARE PREPARED TO INTERVIEW AS REPRESENTATIVES MEN WITH ESTABLISHED CONNECTIONS IN THE ELECTRICAL TRADE FOR POSTS IN A COMPANY WITH RAPIDLY EXPANDING SALES.

ALL ENQUIRIES TREATED IN CONFIDENCE.

WRITE GIVING FULL DETAILS—BOX 2913.

SOUTH EASTERN ELECTRICITY BOARD

SENIOR ASSISTANT ENGINEER (Planning and Development), at Surrey Sub-Area Headquarters, Dorking, Surrey.

Salary £1,795-£1,950 per annum in accordance with N.J.B. Class L, Grade 4. Superannuable. Consideration will be given to a car allowance and to assistance with house purchase in appropriate circumstances.

The appointed person will take charge of the Planning and Development section and will be responsible to the Sub-Area Engineer for the preparation of short and long-term plans for the development of major transmission and distribution throughout the Sub-Area, together with the co-ordination of District H.V. and M.V. planning proposals. Corporate Membership of the I.E.E. is desirable and candidates should have extensive responsible practical experience of distribution works up to 33 kV, in addition to technical planning experience. Surrey Sub-Area, covering some 400 square miles, supplies 309,000 consumers and has a maximum demand of 464 M.W. It is predominantly residential in character with extensive light industry, being partly densely suburban and partly rural.

Applications, quoting ER, on forms from Surrey Manager, SEEBOARD, Rough Rew, Ridgeway Road, Dorking, Surrey, by 22nd November, 1961.

ASSISTANT DISTRICT ENGINEER, Guildford District.

Salary £1,040-£1,165 under N.J.B. Class F, Grade 7. Superannuable. Preference given to applicants with technical qualifications up to H.N.C. standard and with practical experience of the planning, construction, operation and maintenance of M.V. and 11-kV underground and overhead systems. Consideration will be given to a private car allowance and assistance in house purchasing in appropriate circumstances. The successful applicant will be required to undertake standby duties.

Applications, quoting ER, on forms from District Manager, SEEBOARD, Woodbridge Road, Guildford, Surrey, by 22nd November, 1961.

SHOWROOM ASSISTANT, Croydon and Purley District.

Annual salary, including London allowance, £285 at 16 to £490 at 20, rising to £600, £680 or £740 according to qualifications obtained and ability.

Duties will include general showroom work and the advising of consumers on the use of electrical apparatus. The successful applicant may be required to work in any showroom of the Croydon and Purley District. He may also be required to carry out cashier duties.

Applications, quoting ER, and naming two referees, on forms from District Manager, SEEBOARD, Electric House, Wellesley Road, Croydon, by 22nd November, 1961.

GEORGE WRAY,
Secretary.

2910

BIC (SUBMARINE CABLES) LTD.

require an ELECTRICAL ENGINEER to undertake development work, including testing, on submarine power cables and accessories.

The selected candidate will be required to organise and progress the development work up to and including production against customers' requirements.

Applicants should hold an engineering degree, H.N.C. or its equivalent, and preferably have the knowledge of power cable design and manufacture.

Good prospects and salary.

Apply to the Secretary, British Insulated Callender's (Submarine Cables) Ltd., Trafford Park, Manchester, 17.

2827

NORTH WESTERN ELECTRICITY BOARD

Second Assistant Engineer,
Mains Construction Section,
Sub-Area Engineering Department, Manchester

The duties will include the organisation and supervision of mains construction work in the Sub-Area at voltages up to and including 33,000 volts. Applicants should have had considerable experience in the installation and maintenance of underground cable systems in a city area, and have a sound knowledge of cable techniques. Applicants should hold the H.N.C. in Electrical Engineering or its equivalent. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary scale £1,535/£1,720 p.a., Grade M.7. N.J.B. conditions.

Fourth Assistant District Commercial Engineer (Installation),
North-West District, Eccles

Applicants should have had experience in the control and supervision of industrial and domestic contract wiring, including preparation of estimates and specifications, together with delivery and connection.

Salary scale £890/£1,015 p.a., Grade H.11. N.J.B. conditions.

Applications on forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, 2, P.O. Box 493, and returned to him by 20th November, 1961.

Fourth Assistant Engineer,
Sub-Area Engineering Department, Preston

Applicants must have had sound training in the testing and maintenance of protective gear. Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scale £965/£1,090 p.a., Grade L.13. N.J.B. conditions.

Applications on forms to be obtained from the Manager, No. 4 Sub-Area, North Western Electricity Board, 40/41, Lune Street, Preston, and returned to him by 23rd November, 1961.

2874

LONDON ELECTRICITY BOARD

Vacancy: Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's Ravensbourne District at 293/5, Kirkdale, Sydenham, London, S.E.26.

Applicants should have a sound technical education to the standard of the Higher National Certificate and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 9, £1,165 per annum rising to £1,295 per annum, inclusive of London allowance.

Applications should be sent direct to the Manager, Ravensbourne District, at above address, within 14 days of the publication date of this notice. Please quote reference PER/V/3438/R.

2912

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE CO. LTD.

Longridge House, Manchester, 4

ELECTRICAL SURVEYORS required in England and Scotland. Permanent positions carrying progressive salary scale £825 to £1,225 with non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience.

2866

NEWCASTLE REGIONAL HOSPITAL BOARD

Appointment of One Mechanical and One Electrical Engineering Clerk of Works

APPLICATIONS are invited for the posts of Mechanical and Electrical Engineering Clerks of Works in the Department of the Regional Engineer.

The posts are permanent and superannuated under the National Health Service Superannuation Regulations, 1955.

The salary scale is £800 × £40 (5) × £50 (1) to £1,050 per annum.

The Electrical Clerk of Works will be required to cover either part or the whole of the Region extending from Berwick-upon-Tweed to Northallerton; also the counties of Cumberland and North Westmorland.

The Mechanical Engineering Clerk of Works will be required to cover principally the Tyneside area and the county of Northumberland.

Candidates will be required to provide their own transport—mileage allowances payable.

The duties of the Electrical Engineer will be to supervise the installation of all internal wiring, equipment of buildings, external distribution, substation equipment and street lighting, central telephone installations, radio and staff location equipments, also lift installations.

The duties of the Mechanical Engineer will be to supervise installations of steam boiler plant, mechanical coal-fired and automatic oil-fired units, steam distribution services, heating hot and coal water and gas installation, also piped medical gases, ventilation equipment, laundry machinery, central kitchen equipment and lift installations.

It will be necessary for the successful candidates to prepare fully detailed technical written reports on each project, and these are to be submitted to the Regional Engineer each week.

Applications stating age, qualifications, experience, past and present appointments and salary, together with names and addresses of three referees (two technical), should be forwarded to the Secretary, Regional Hospital Board, Benfield Road, Newcastle upon Tyne, 6, within 14 days.

Canvassing will disqualify.

2882

ENGINEERING DESIGNER-DRAUGHTSMEN

required by

AIR MINISTRY IN LONDON

SALARY (inner London scale) Grade II, £1,048 to £1,215; Grade III, £658 to £1,048 (£866 at age 25); starting salary depends on age, quals. and exp.

Electrical Engineering Designer-Draughtsmen experienced in preparation schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution. Some mechanical experience an advantage.

Candidates should have served recognised apprenticeship or had equiv. training and also adequate practical experience. Possession of recognised technical qualification an advantage; financial assistance and time off may be allowed for recognised courses of study for technical qualifications. 5-day week with 26½ days' paid leave p.a. initially, including public holidays. Promotion and pension prospects. Some overseas tours with special allowances in addition to salary.

Applicants, who must be natural-born British subjects, should write to AIR MINISTRY, W.G.d/(BH), LACON HOUSE, THEOBALDS ROAD, LONDON, W.C.1, giving age, details of training, quals., full particulars of former posts held, or apply to any Employment Exchange, quoting Kings Cross O/N.2254. Candidates selected will normally be interviewed in London and certain expenses reimbursed.

271

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

South Western Region

GRADE 10 ENGINEER POOLE GENERATING STATION

THE successful applicant will be given the opportunity of gaining experience in oil-fired plant operation, control room duties and maintenance work. Operating experience of modern generating station plant is essential.

Preference will be given to those possessing qualifications leading to membership of a recognised professional institution or equivalent qualifications.

Salary N.J.B. Grade K/10, Scale 9, £1,115 to £1,245.

Special application forms obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 22nd November, 1961.

2893

CENTRAL ELECTRICITY GENERATING BOARD

Southern Project Group

Technical Clerk

APPLICATIONS are invited for the position of TECHNICAL CLERK in the Programme Engineer's Department at Project Group Headquarters, Squires Lane, Finchley, London, N.3.

The work will be connected with the preparation of engineering design standards and associated activities. The duties will be to assist in the collation and classification of a wide range of civil, mechanical and electrical data and to maintain a library of technical information.

The successful candidate should have had a good general education, possess an inquiring mind and be painstaking and thorough in attitude.

The salary will be within Grade 2 of the National Joint Council Agreement, i.e., £740-£815 per annum inclusive of London allowance.

Applications stating age, experience, present position and salary should be forwarded to the Administrative Officer, Central Electricity Generating Board, Southern Project Group, Squires Lane, Finchley, London, N.3, so as to arrive not later than 15th November, 1961.

Envelopes should be marked "CONFIDENTIAL, S/61/24."

2870

TECHNICAL SALES REPRESENTATIVE

REPRESENTATIVE required to be based on our Bristol office and to cover the South-West of England for the sale and application of transformers and of power capacitors. A knowledge of the area and some experience of technical sales are desirable but not essential.

Applications in confidence to :—

Sales Director
BRYCE ELECTRIC CONSTRUCTION CO. LTD.
Kelvin Works, Hackbridge, Surrey

2888

AIR MINISTRY WORKS DEPARTMENT

invites applications for positions as STATION ENGINEERS Grade III at R.A.F. and Ministry of Aviation establishments throughout the United Kingdom to supervise the installation, operation and maintenance of electrical and/or mechanical plant.

SALARY, which is dependent upon age, quals. and exp., ranges in the U.K. from £801 (National rate) at age 25 to £988 max. in Grade III.

QUALS. and EXP. Applicants, who must be natural-born British subjects up to age 35, should have served an apprenticeship and should hold an O.N.C. or C. & G. Technical Cert. or 2nd Class M. of T. Cert. or equiv. Experience is required in one or more of the following :—

Electrical generation.
Electrical distribution, H.T. and L.T.
Electrical installations, industrial & domestic.
Light current and/or electronic engineering.
Ventilation and air conditioning.
Heating and hot water supply.
Compressed gases and refrigeration.
Bulk fuel installation.
Diesel engine-driven plant.

Internal training courses provided and financial assistance and time off may be allowed for recognised courses of study leading to higher qualifications.

PROSPECTS. Appointments are non-pensionable but retirement/resignation gratuity payable after 5 years' or more service. Excellent opportunities of obtaining permanent pensionable posts (with all service counting) and of advancement to the higher grades in which posts number 480 approx.

Higher grade salaries vary between £988 and £1,747 p.a. (National rate) and vacancies are, as a rule, filled by promotion of serving staff. Opportunities for overseas tours for which special allowances ranging at present up to £1,800 p.a. are payable in addition to a higher salary. 5-day week with 26½ days' paid leave a year initially including public holidays.

Forms from Manager (PE.1), Ministry of Labour, Professional and Executive Register, Atlantic House, Farringdon Street, London, E.C.4. Candidates selected will normally be interviewed in London and certain expenses reimbursed. Only applicants selected for interview will be advised.

269

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern Region

Fourth Assistant Engineers (Substations)

APPLICATIONS are invited from Engineers to supervise the work of contractors engaged on the installation of transformers, switchgear, cables and associated equipment at Transmission Substations based on Leeds.

Previous experience of this work is desirable but not essential.

Varied and interesting developments are taking place in the Region on the introduction of the 400-kV system which candidates will in time be expected to supervise.

Preference will be given to candidates who possess or are completing qualifications leading to Corporate Membership of the I.E.E.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Grade 11, Class K (£900 - £1,165 per annum).

Forms of application may be obtained from the Regional Personnel Officer, Central Electricity Generating Board, North Eastern Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than 20th November, 1961.

2894

Situations Vacant *(continued)*

Eastern Electricity

Norfolk Sub-Area Headquarters
(228/61.R)

SECOND ASSISTANT ENGINEER
(Planning and Development).

Applicants should have a thorough knowledge of substation design and have had a wide experience in the planning and development of underground and overhead distribution systems up to and including 33 kV.

The duties include budgetary control of capital expenditure and programming of engineering schemes.

Candidates should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications, and be accustomed to controlling staff.

Salary N.J.B. Class K, Grade 7, £1,350-£1,500.

Apply by letter to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4, Duke Street, Norwich, Norfolk, NOR. 23A, by 24th November, 1961.

Essex Sub-Area
(226/61.R)

THIRD ASSISTANT ENGINEER,
CHELMSFORD DISTRICT.

Applicants should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class G, Grade 9, £965-£1,090.

Apply by letter to D. H. Walker, A.M.I.E.E., Manager, Chelmsford District, Eastern Electricity Board, Anchor Street, Chelmsford, Essex, by 20th November, 1961.

Northmet Sub-Area
(229/61.R)

THIRD ASSISTANT ENGINEER,
HENDON DISTRICT
(Ref. 1023).

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class H, Grade 9, £1,090-£1,215, including London allowance.

Apply by letter, quoting reference ER, to F. A. Moinet, M.I.E.E., A.M.B.I.M., Manager, Eastern Electricity Board, 137/9, Brent Street, Hendon, by 24th November, 1961.

2904

CROMPTON PARKINSON LIMITED

Service Engineer, London Area

AN intelligent young man in the 20/25 years age group, resident in the London area, is required as a Service Engineer.

He should have had practical experience in the manufacture, maintenance or repair of fractional motors, and must have a knowledge of electrical machinery.

Preference will be given to applicants with a Higher National Certificate in Electrical Engineering, but consideration will be given to those with Ordinary National Certificate who are prepared to continue their studies at evening classes.

This appointment will carry a good starting salary and is progressive and pensionable.

Apply by letter giving all essential details to the Chief Personnel Officer, Crompton Parkinson Limited, Crompton House, Aldwych, London, W.C.2.

2859

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Region, North Thames Division

APPLICATIONS are invited for the following appointment at West Thurrock Generating Station (Grays, Essex) :—

ASSISTANT MAINTENANCE
ENGINEER (Instruments)
(S.V. No. 1558).

Salary N.J.B. Class M, Grade 12, Scale 9, £1,115-£1,245 plus London weighting £50 per annum, rising eventually to Class N, Grade 12, Scale 10, £1,190-£1,325 per annum plus London weighting £50 per annum.

Suitable candidates must have a thorough knowledge of general electronics, with an emphasis on pulse circuit technique. An understanding or experience of instrumentation and/or transistors will be an advantage. His practical training should be preferably either an apprenticeship with a major radio firm or ex-Royal Air Force radar mechanic. Technical qualifications would be an advantage. The post is intended for a technician whose duties will include the maintenance of a Ferranti Argus digital computer and its peripheral equipment.

Applications, quoting reference S.V. No. 1558, stating age, qualifications, experience and present position should be sent to the Assistant Regional Personnel Officer, Central Electricity Generating Board, South Eastern Region, North Thames Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., to arrive not later than 23rd December, 1961.

F. W. SKELCHER,
Assistant Regional Director.

2889

FEDERAL GOVERNMENT OF NIGERIA

VACANCIES FOR INSPECTING ENGINEERS

QUALIFICATIONS: Corporate Membership of the Institution of Electrical Engineers or equivalent qualification. Thorough knowledge of the electrical supply and wiring regulations as they apply in the United Kingdom coupled with extended experience of the construction, operation and maintenance of overhead lines operating at voltages of 11 kV and over is essential.

Salary according to qualifications and/or experience in the range £1,434-£2,196 p.a. Gratuity of £150 p.a. payable.

Write for application forms and further particulars, stating briefly age, qualifications and experience, to the Recruitment Attaché, Nigeria High Commission, 9, Northumberland Avenue, London W.C.2, quoting ref. Q.1/3.

2884

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

No. 4 Sub-Area

ASSISTANT SECTION ENGINEER required at Machynlleth. Salary within the range £825/£940 per annum (N.J.B. E.9, Scale 5).

Applicants should preferably have had experience in the construction, operation and maintenance of overhead and underground high and medium-voltage networks with their associated substations and equipment.

Appointment subject to medical examination. Pension scheme.

Application forms obtainable from the Manager, No. 4 Sub-Area, Electricity House, Rhostyllen, near Wrexham. Closing date 24th November, 1961.

2897

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Region

East Midlands Division

ASSISTANT ENGINEER (Control Room),
LEICESTER POWER STATION
(Vacancy No. 235/61).

Applications are invited for the position of Assistant Engineer (Control Room) at Leicester Power Station, Rawdykes Road, Leicester. Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class G, Grade 13 (£715 - £805 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications, 17th November, 1961.

This appointment is pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent and should be returned to him by the date stated.

O. S. WOODS,
Assistant Regional Director.

2900

NORWICH CITY COLLEGE AND ART SCHOOL

Ipswich Road, Norwich, Norfolk, NOR 67 D

Principal: Frank Briers, O.B.E., B.Sc., D.Phil.(Oxon.), B.Sc.(Lond.), F.R.I.C.

WANTED, Full-time TEACHER OF ELECTRICAL ENGINEERING, to commence duties on 1st January, 1962. Applicants should possess either a Higher National Certificate in Electrical Engineering or City and Guilds B and C Certificates in Electrical Installation Work. Some industrial experience, particularly in Installation Work, desirable. Teaching will be mainly for City and Guilds A, B and C Installation Courses, but there will be ample opportunity for work of a more advanced nature.

Salary in accordance with Burnham Technical Scale, Grade B, at present £700 rising by £27 10s. to £1,150 per annum, with appropriate allowance for approved industrial experience.

Application forms, which may be obtained from the Director of Education, City Hall, Norwich, NOR 01 A, on receipt of a stamped addressed envelope, should be returned to the Principal as soon as possible.

2869

LEADING DRAUGHTSMEN

THE Engineer-in-Chief's Department, Trinity House, London, requires (a) one LEADING DRAUGHTSMAN (Mechanical) and (b) one LEADING DRAUGHTSMAN (Electrical). Applicants for post (a) should be experienced pipework draughtsmen, preferably with some knowledge of diesel and compressor plant layouts, and for post (b) should be experienced in light current relay circuitry and switching techniques associated with automatic control and instrumentation.

Qualifications for both posts should include sound practical training, five years' drawing office experience, and the possession of an O.N.C. or equivalent qualification.

Salary scale £1,048 rising by various annual increments to £1,220 per annum maximum.

Applications should be made in writing to the Secretary, Trinity House, Tower Hill, London, E.C.3, not later than 18th November, 1961, stating age, present occupation, qualifications and experience, and enclosing copies of recent testimonials.

2857

YORKSHIRE ELECTRICITY BOARD

Head Office

THIRD ASSISTANT ENGINEER,
Distribution Design (Substations).

Duties will include the design of indoor and and outdoor substations operating at voltages of 33 kV and above, the preparation of specifications for substation plant and subsequent negotiations with plant manufacturers. They will also cover protective gear applications on the primary H.V. system.

Applications are invited from engineers having a sound general knowledge of substation plant and some experience of field construction.

Salary N.J.B. Class K, Grade 8 (transitional to Scale 11), within the range of £1,145 to £1,410 per annum. The commencing salary will be dependent upon qualifications and experience.

Applications, together with the names of two referees, should be sent to the Secretary, Yorkshire Electricity Board, Wetherby Rd., Scarcroft, Leeds, not later than 24th November, 1961.

No. 2 (Huddersfield) Sub-Area
HALIFAX DISTRICT

GENERAL ASSISTANT DISTRICT ENGINEER (Draughtsman).

Applicants should have had a good general and technical education. The successful candidate will be responsible for the supervision of the District mains records drawing office, and will be required to prepare plans for capital schemes, wayleaves and statutory notices.

Salary N.J.B. Class J, Grade 14 (Scale 4), £765/£870 per annum.

Applications, together with the names of two referees, should be sent to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market Street, Huddersfield, not later than 24th November, 1961.

2898

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

ASSISTANT ENGINEER (Control) is required at Nechells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.14, £825-£940 per annum plus 10% shift allowance (minimum £90).

Applicants should have received a sound technical and practical training and should preferably possess suitable technical qualifications. Duties will be in connection with the control of steam generating plant and main switchgear.

Apply, quoting Vacancy No. 252/61MR, on form AE6, available from the Station Superintendent, Nechells Power Station, off Aston Church Road, Nechells, Birmingham, 7, to be completed and returned by 20th November, 1961.

2902

MECHANICAL, ELECTRICAL AND HEATING AND VENTILATING ENGINEERING DRAUGHTSMEN

PENSIONABLE posts for men and women aged at least 20 on 1.6.61, with at least 3 years' training, including adequate practical experience with appropriate technical study. Appropriate O.N.C. is essential, and at least one year must have been spent in full-time drawing office work.

Salary (Inner London) £617 (at 20) to £960 (at 28 or over). Scale maximum £1,048. Promotion prospects.

Write Civil Service Commission, 17, North Audley Street, London, W.1, for application form, quoting **S/68-69/61.** Closing date 29th December, 1961.

2872

UNIVERSITY OF BRISTOL

Electrical Engineering Department

APPLICATIONS are invited for a LECTURESHIP (Grade II) in ELECTRICAL ENGINEERING. Candidates must have good academic qualifications in electrical engineering, physics or mathematics; and some training and/or experience in the applications of electricity. An interest in electrical power and machinery, in which the facilities for research are exceptionally good, is desirable.

The post will be vacant on 1st April, 1962, but a later (or earlier) starting date might be arranged. Applicants should give full particulars of age and career to date, and the names of at least two persons to whom reference may be made. Salary according to age and experience, on the scale £1,050 to £1,850, with family allowance (where appropriate) and superannuation on F.S.S.U. terms.

Applications (or provisional enquiries from interested persons) should be submitted as soon as possible to the undersigned, from whom further particulars may be obtained.

H. C. BUTTERFIELD,
Registrar and Secretary.

2725

NORTH WESTERN ELECTRICITY BOARD

Sub-Area Commercial Officer,
No. 6 Sub-Area, Kendal

APPLICATIONS are invited for the above post from suitably qualified engineers. A wide knowledge of industrial, commercial, rural and domestic electrification is essential. Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Conditions of employment will be in accordance with the National Joint Managerial and Higher Executive Grades Agreement and the salary will be Class C, Grade 5 of that Agreement (£2,170-£2,380 per annum).

Applications on forms to be obtained from the Secretary, North Western Electricity Board, Cheetwood Road, Manchester, 8, and returned to him by 22nd November, 1961.

2873

TECHNICAL SALES ENGINEER

MAWDSLEY'S LIMITED
Dursley, Glos.

MAKERS of special-purpose rotating electrical machinery with wide and varied applications require technical qualified (Degree or H.N.C.) Sales Engineer in the London area.

Experience in design or manufacture of the company's type of product and related sales experience are essential qualifications.

Salary will be negotiated. A pension and life assurance scheme is in operation.

Applications will be treated in ABSOLUTE CONFIDENCE and should be addressed to the Personnel Adviser, giving a full summary of career and training.

2875

LIGHTING SALES ENGINEER

EXPERIENCED man required in West London and West Home Counties, preferably resident in the area.

Attractive salary offered to applicant having required sales and technical ability. Car provided and opportunity to join superannuation scheme.

Write in confidence giving details of experience, age, present salary, etc., to Southern Area Manager, Benjamin Electric Ltd., Tottenham, London, N.17.

2865

MIDLANDS ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER (Civil) required at Central Gloucestershire Area Office.

Applicants should have building and civil engineering experience and a knowledge of quantities. Possession of suitable qualifications will be an advantage. Duties include the supervision of contracts and direct labour and the ordering of materials, etc., for offices, service centres, stores and general building and maintenance work.

Salary £890/£1,015 per annum (N.J.B. Grade K.13). Superannuable.

Apply by letter within 14 days, stating age, experience, qualifications, present position and salary, to Mr. S. Raybould, Area Manager, Midlands Electricity Board, Eastern Avenue, Gloucester.

F. W. CATER,
Secretary.

2880

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

Fourth Assistant Engineer,
Stourport Transmission District

FOURTH ASSISTANT ENGINEER is required in the Stourport Transmission District. N.J.B. Agreement conditions, superannuable appointment, salary within Schedule B, Class L, Grade 9, commencing at a figure commensurate with qualifications and experience. The salary range is £1,070-£1,410 per annum.

Candidates should preferably possess a Higher National Certificate in Electrical Engineering or equivalent qualifications and should have had some experience in overhead lines and/or substations. Experience in protective gear, metering or communications would be an advantage. Successful candidate will have opportunity for interchange of duties associated with E.H.V. transmission plant.

Apply, quoting Vacancy No. 250/61 MR, on form A.E.6, available from Mr. S. S. Tyler, Stourport District Engineer, Central Electricity Generating Board, Stourport District Office, Worcester Road, Stourport-on-Severn, Worcs., to be returned by 20th November, 1961.

2881

LONDON ELECTRICITY BOARD

Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's Northern District at 18/24, Lower Clapton Road, London, E.5.

Applicants must have had a thorough theoretical and practical training and should have had comprehensive experience of development, construction and maintenance of L.V. and H.V. distribution systems, together with the associated administrative work and the control of labour. Corporate or Graduate Membership of the Institution of Electrical Engineers, or the equivalent, would be an advantage.

The post is graded under Schedule A of the National Joint Board Agreement as Class J, Grade 7, £1,325 rising to £1,460 per annum, inclusive of London allowance.

Applications, stating age, qualifications and experience, should be sent to the Manager at the above address, within 14 days of the publication date of this notice. Please quote ref. PER/V/3437/R.

2911

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

Richborough Generating Station

APPLICATIONS are invited for the following appointments at Richborough Generating Station, at present being constructed on the Kent coast between Ramsgate and Sandwich.

The ultimate capacity of the station is 3 120-MW reheat units.

5 SHIFT CHARGE ENGINEERS (Vacancy No. 271/61).

Applicants should have had considerable operational experience in a large modern power station.

Salary N.J.B. Class K, Grade 6, £1,584—£1,771 per annum, including shift allowance.

10 ASSISTANT SHIFT CHARGE ENGINEERS (Vacancy No. 272/61).

Applicants should have had considerable operational experience in power stations. Each successful applicant will be employed in the Central Unit Control Room and on general duties within the power station for equal periods.

Salary N.J.B. Class K, Grade 8, £1,402 10s. to £1,551 per annum, including shift allowance.

ASSISTANT ENGINEER (Draughtsman) (Vacancy No. 273/61).

The successful applicant will be responsible for production of mechanical, electrical and civil drawings originated at the station, and for the custody of all drawings supplied to the station.

The probable date of this appointment will be 1st February, 1962.

Salary N.J.B. Class K, Grade 12, £965-£1,090 per annum.

Applications giving age, details of experience, qualifications, etc., and quoting vacancy number, should be sent to the Personnel Officer, Central Electricity House, Lower Ham Road, Kingston-upon-Thames, Surrey, to arrive by 20th November.

2903

BUCKINGHAMSHIRE EDUCATION COMMITTEE

Slough College of Further Education

(Principal R. Edgar, M.Sc., M.A.)

REQUIRED for the 1st January, 1962, or as soon as possible thereafter:—

LECTURER IN ELECTRICAL ENGINEERING, mainly for O.N.C. and H.N.C. classes. This post is additional to the one recently advertised.

Salary on the Burnham Further Education Report, viz., £1,370 to £1,550 per annum.

Further particulars may be obtained from the Principal, College of Further Education, William Street, Slough, to whom completed forms should be returned by 22nd November, 1961.

2905

NORRIS CONSULTANTS LIMITED

require in the Bristol and Reading offices

ELECTRICAL ENGINEERS.
ELECTRICAL DESIGNER/DRAUGHTSMEN.

Applications are invited from engineers and draughtsmen with experience in building installations, distribution and control equipment.

Send full details, quoting reference M.R.N., to Beacon House, Queen's Road, Clifton, Bristol, 8.

2914

TECHNICAL OFFICER

The British Electrical Development Association requires a technical officer specially expert in promoting the use of electricity for domestic purposes. Ability to write fluently and clearly is essential. Knowledge of publicity and film making very advantageous. Corporate membership of I.E.E. desirable. Salary in the region of £2,000 depending on age and qualificatons.

Applications, giving full particulars of education, training, qualifications, age and experience to be sent before 1st December to:—

Director & Secretary
The British Electrical Development Association
2 Savoy Hill, London, W.C.2

2887

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

Yeovil District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B. Class G, Grade 11 £825-£940 per annum). N.J.B. conditions of service.

The successful candidate will be required to assist in the preparation of schemes and estimates for extensions of, and reinforcement to, overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in electricity supply distribution, and the possession of suitable technical qualifications would be an advantage. The successful candidate will be required to carry out standby duties if and when called upon to do so.

The successful applicant will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 1, Priory Road, Bournemouth, and returned to him, quoting Z.1431, not later than 20th November, 1961.

2909

ASSISTANT MAINS ENGINEERS

required by the ADEN GOVERNMENT ELECTRICITY DEPARTMENT on contract for one tour of 18/24 months in first instance. Salary (including inducement allowance) according to age and experience in scale rising to £2,295 a year. Gratuity at rate of 12½% of total salary drawn. Children's education allowances. Free passages.

Candidates, preferably under 45 years of age, must have had sound technical training and subsequent experience in design and construction of overhead and underground distribution systems up to and including 33 kV.

Apply to CROWN AGENTS, 4, Millbank, London, S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience, and quoting reference M2A/51474/EF.

2883

OVERSEAS ELECTRICAL CONTRACTOR

requires competent BRANCH MANAGER for West Africa with contracting experience from enquiry to final account and experience of controlling branch with turnover of £½M.

Excellent conditions and prospects. Full details given at interview.

Applications in writing giving details of past experience to—Box 2860.

ADMIRALTY

requires temporary PRODUCTION INSPECTORS with experience in either Mechanical, Electrical, Electronic or Marine Engineering. Vacancies mainly in London, Bath, Portsmouth, Liverpool, Barrow, Glasgow and Newcastle.

Duties involve work in connection with manufacture, inspection, test and installation of equipment in H.M. ships. Age at least 25, with recognised apprenticeship or equiv. training plus additional relevant experience with industry or Government department.

Candidates should possess H.N.C. or O.N.C. in Mechanical or Electrical Engineering, or have reached at least an equiv. standard of technical education with quals. in appropriate subjects. Opportunities may occur later to compete for permanent posts.

SALARIES: Assistant Production Inspector, Grade III, £801 at age 25 to £884 at age 28 to £988. Production Inspectors, Grade II, £988 to £1,128.

Forms from Ministry of Labour, Technical and Scientific Register (K), 28, King Street, London, S.W.1, quoting **D.551/1A.** Closing date 24th November, 1961.

2871

LONDON ELECTRICITY BOARD

Assistant Distribution Engineer

APPLICATIONS are invited for the above position in the Board's West End District at 25, Eccleston Place, London, S.W.1.

Applicants should have had a sound technical education to the standard of the Higher National Certificate, and possess practical experience in all branches of engineering work associated with the organisation of a District distribution department.

The post is graded under Schedule A of the National Joint Board Agreement as Class K, Grade 11, £1,090 per annum rising to £1,215 per annum, inclusive of London allowance.

Applications, stating age, qualifications and experience, should be sent to the Manager at the above address, within 14 days of the publication date of this notice. Please quote ref. PER/V/3424/R.

2861

CENTRAL ELECTRICITY GENERATING BOARD

South Thames Division

Northfleet Power Station

ASSISTANT ENGINEER (Shift) (Vacancy No. 269/61). This position is for general operational duties on shift and relevant experience within a modern generating station is required.

Salary N.J.B. Class M, Grade 10, £1,452 10s. to £1,601, including London and shift allowances.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Northfleet Power Station, Crete Hall Road, Northfleet, Kent, to arrive by 17th November.

2899

COUNTY COUNCIL OF ESSEX

ASSISTANT ELECTRICAL ENGINEER, Grade III, A.P.T.D. Commencing salary according to qualifications and experience, but not exceeding £1,140.

Candidates should have obtained O.N.C. and be capable of designing, under supervision, electric lighting, heating and power schemes.

Five-day working week. Assistance towards removal expenses will be given in approved cases.

Application form from H. Conolly, C.B.E., F.R.I.B.A., County Architect, County Hall, Chelmsford, returnable by 24th November, 1961.

2917

EAST MIDLANDS ELECTRICITY BOARD

Lincolnshire Sub-Area

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointment. Applicants should state age, qualifications, experience, etc., and quote the vacancy number.

THIRD ASSISTANT DISTRICT ENGINEER, Boston District (Re-advertised Vacancy No. 104/61).

Salary N.J.B. Class F, Grade 9, £890 to £1,015 per annum.

The duties will include assisting in the operation, maintenance, planning and construction of rural and urban networks up to and including 11 kV.

The person appointed will be required to live in or near Boston, and to undertake stand-by duty.

Applications should be forwarded to the Manager, Lincolnshire Sub-Area, North House, Grantham, Lincs., by the 24th November, 1961.
2908

TECHNICAL SALES ENGINEER

A PROGRESSIVE and rapidly expanding company, manufacturing automatic control gear, requires a specialist Sales Engineer for the North Midland and Northern England territory for Rotary Switch sales.

Essential qualifications should include knowledge of contemporary rotary switches plus existing trade connections in the electrical industry, electronics, machine tool and computer fields, plus ability to negotiate at all levels.

Attractive commencing salary, plus non-contributory pension scheme and company car provided, plus ample opportunities for advancement.

Applicant should reside in or near Manchester, Sheffield or Nottingham areas.

Box 2858

BRIGHTON EDUCATION COMMITTEE

Brighton Technical College

Principal: G. E. Watts, C.B.E., M.A., Ph.D.(Cantab), B.Sc.(London), F.R.I.C.

REQUIRED for 1st January, 1962:—LECTURER IN ELECTRICAL ENGINEERING to teach to final degree and diploma standards. Ability to offer a specialist subject an advantage. Degree, or corporate membership of professional institution, plus teaching experience required.

Salary £1,370 by £35 (4) plus £40 to £1,550 (under review). Increments may be allowed in this scale for approved experience.

Further particulars and forms of application from the undersigned, to be returned to the Principal, Brighton Technical College, Richmond Terrace, Brighton, 7, not later than 21st November, 1961.

W. G. STONE,
Director of Education.

54, Old Steine,
Brighton.
2837

A SENIOR and a junior electrical engineer required in Glasgow by a large organisation for the preparation of drawings, specifications and installation of a wide variety of equipment. Write Chief Engineer, The Distillers Co. Ltd., Engineering Division (North), 64, Waterloo Street, Glasgow, C.2, stating age, experience, qualifications and salary expected. 2878

AN experienced armature winder, also an electrical tester, is required by Max Arc Ltd., of Walton-on-Thames, Surrey. Congenial atmosphere. Good prospects for the right person. 176

WANTED

ELECTRICAL ENGINEER

(aged about 30-35)

for estimating and supervising electrical contracts. Good salary and bonus paid to keen, energetic man capable of accepting responsibility. Permanent position with pension.

Assistance with housing if necessary.

Applications in writing (stating age, experience, technical qualifications and salary required) will be treated with STRICTEST CONFIDENCE and should be made to:—

Messrs. A. ANDERSON & SON
(ELECTRICAL ENGINEERS) LTD.
100, Grange Road, Middlesbrough
2826

CENTRAL ELECTRICITY GENERATING BOARD

West Midlands Division

STATION SHIFT CONTROL ENGINEER is required at Nechells "A" and "B" Power Stations, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade K.10, £1,115-£1,245 per annum, plus 10% shift allowance.

A sound technical training and practical experience in the control of steam generating plant and main switchgear are required. Appropriate technical qualifications an advantage.

Apply, quoting Vacancy No. 251/61MR, on form AE6, available from the Station Superintendent, Nechells Power Station, off Aston Church Road, Nechells, Birmingham, 7, to be completed and returned by 20th November, 1961.
2901

CORPORATION OF LONDON

APPLICATIONS are invited from suitably experienced candidates for the permanent post of RESIDENT DEPOT SUPERINTENDENT (Mechanical and Electrical Equipment) at the Corporation's new Public Cleansing Depot, Upper Thames Street, London, E.C.4. salary scale £990-£1,310 p.a. Commencing salary according to qualifications and experience and with free flat accommodation at the depot, available twelve months after appointment.

Candidates should hold a National Certificate in Mechanical and/or Electrical Engineering. Preference will be given to those experienced in maintenance of industrial plant, including oil-fired steam boiler plant and various types of electrical switchgear and motors.

Applications stating age, appointments held and experience, together with names of two referees, to the City Engineer, Guildhall, London, E.C.2, by 14th November, 1961.
2788

ADDITIONAL supervising engineer for London contractor. One able to run contracts from inception to final accounts and be responsible to manager for same. Only person who has had several years' experience in similar capacity would suit. Good salary and prospects. —Box 106.

BP has a vacancy for a senior electrical draughtsman at its head office in London. Applicants, aged 25-35, should have completed an apprenticeship in electrical engineering and be in possession of H.N.C. (Electrical) or equivalent, and have had experience on electrical installations for process plants, workshops and factories. This work will involve visits to company installations in the U.K. and overseas. Salary according to age and experience. Non-contributory pension scheme. Removal and settling-in allowances payable in certain cases. Luncheon club. Write, quoting reference H.5244C, to Box 6886, c/o Hanway House, Clark's Place, London, E.C.2. 2862

BOOK-keeper, male or female. This is a responsible position and a good salary will be paid. Please state present earnings and when available. Refs. would be required.—Box 107.

CHIEF inspector, fully experienced, required by relay and electrical control gear manufacturers to take charge of test department. Boreham Wood, Herts. district. Telephone Elstree 2291 or write to—Box 2832.

CONSULTING engineers require senior electrical designer (building services) capable of planning and designing services all types buildings, including boiler houses, etc., with minimum supervision. Junior also required. Send details—Hoare, Lea & Partners, Building 332 (South Side), R.A.F., Northolt, Ruislip, Middlesex. 8375

CONTRACTORS who specialise in overhead line and cable laying contracts require young engineers and young foremen with experience and initiative.—Box 2789.

CONTRACTS engineer required for the London area. Experienced in installation of high-voltage cables. Good opportunity for right man. Car provided and pension fund. Applications treated as confidential.—Box 8377.

ELECTRICAL cable makers require experienced representative for Scotland. Remuneration above average with ample scope for improvement. Successful applicant would be required to take control of branch premises in Glasgow. Some experience of the radio and television industry would be an added advantage. Car provided. Pension scheme. Apply in strict confidence to Sales Director, Permanoid Limited, Manchester, 4. 2863

ELECTRICAL contractors of repute in Leeds require experienced estimator, knowledgeable of large industrial and commercial installations, etc. Excellent prospects of promotion to energetic and capable person.—Box 2864.

ELECTRICAL draughtsman/engineer required by electrical consultants.—Brown & Hooker, 123 Warwick Rd., London, S.W.5. 2790

ELECTRICAL engineer (25-35) required, to be trained to become chairman of medium-sized old-established private company with increasing turnover and prospects. No finance required. Send brief particulars age, education, experience to—Box 2895.

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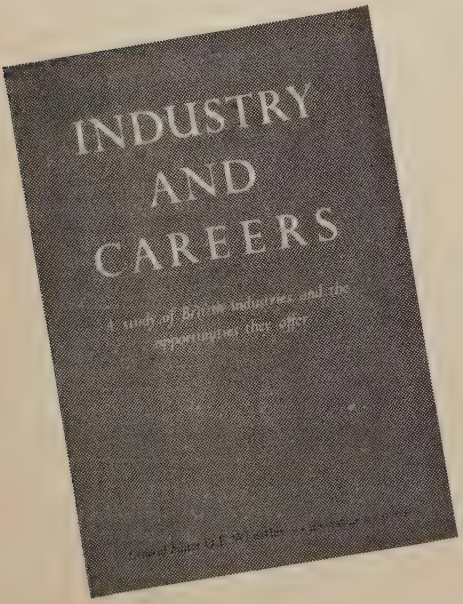
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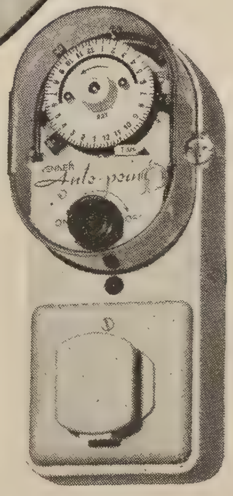

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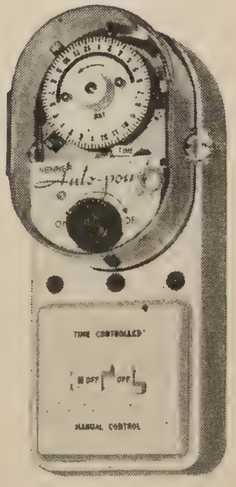

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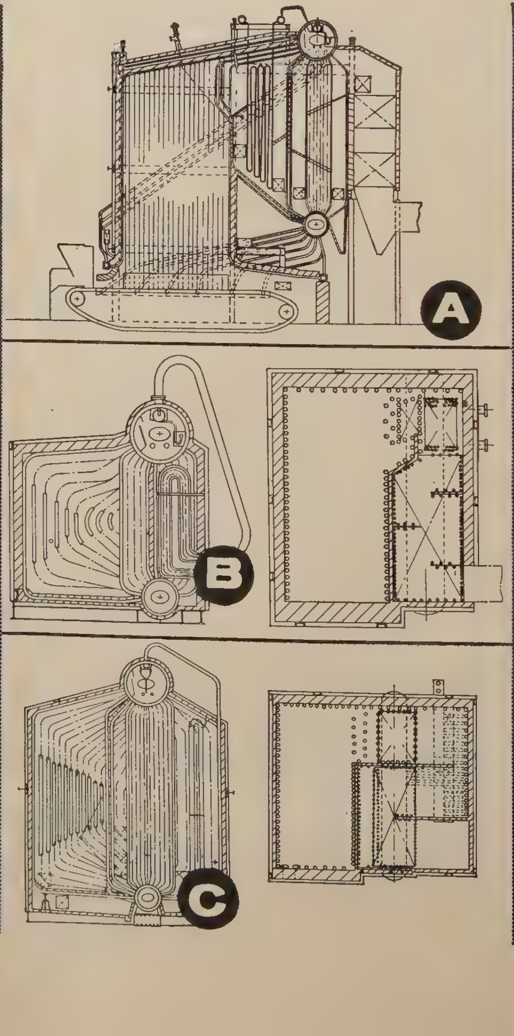

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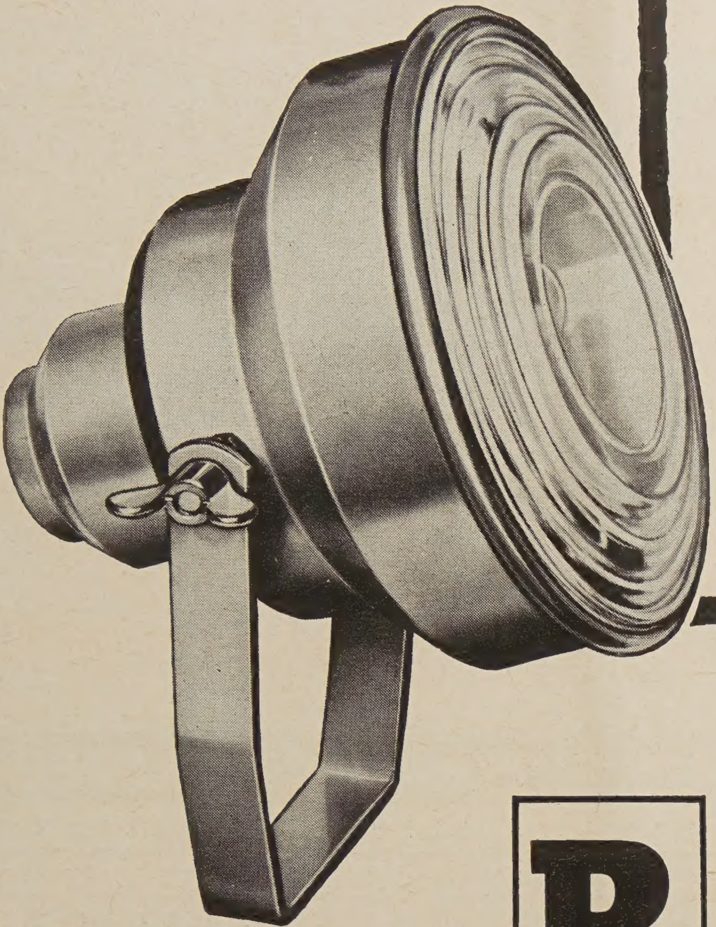

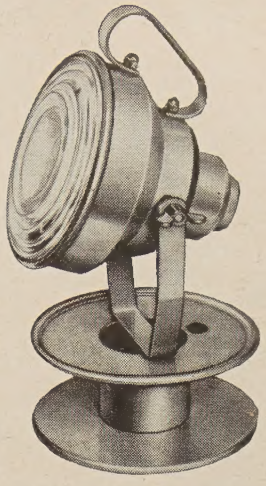

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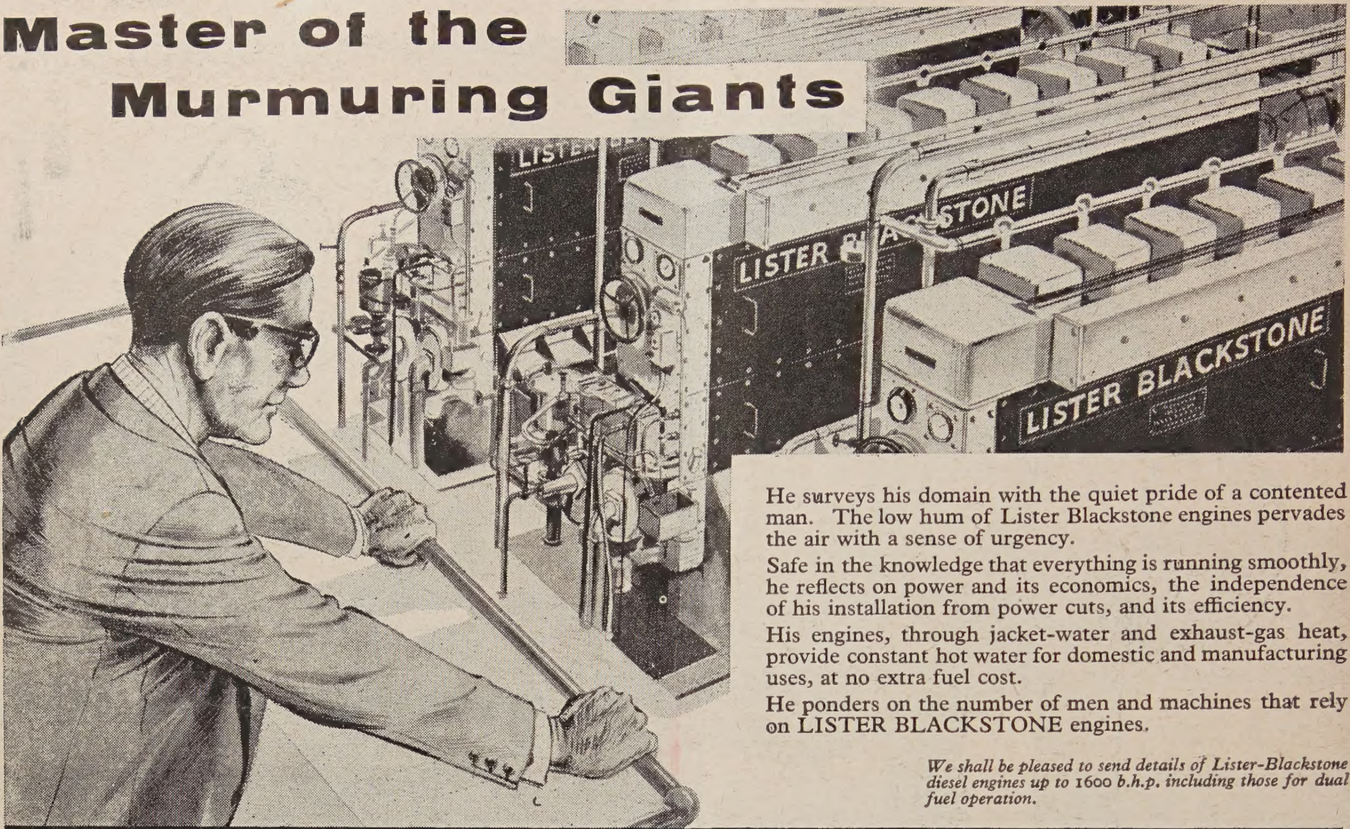

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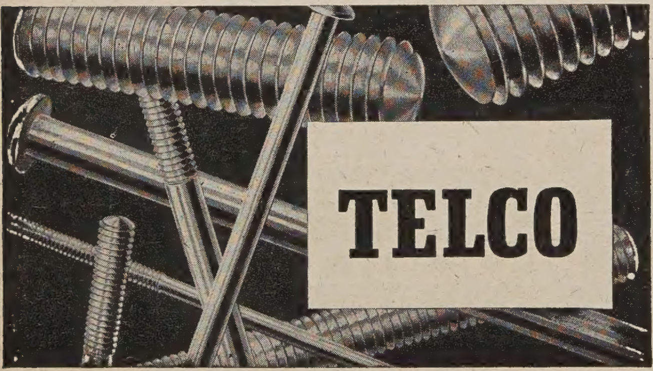

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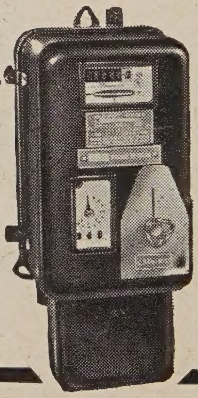

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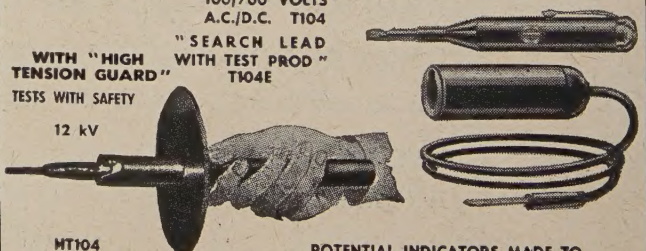

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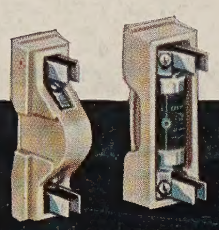
Fuses are of the new 'Kantark-Exel' pattern which will accept semi-enclosed rewirable or H.R.C. Fuses.

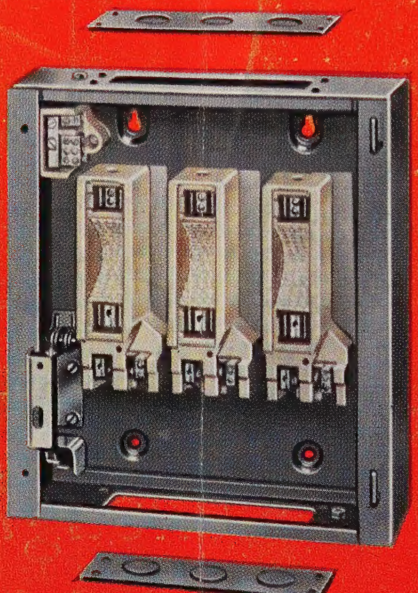
Semi-enclosed rewirable (damper type) patterns comply with B.S. 3036: 1958.

Modern buildings demand switchgear of sound technical performance and compliance with the latest relevant British Standards, and that is in harmony with the most modern surroundings. The 'Exel' range of switchgear will meet all these requirements.

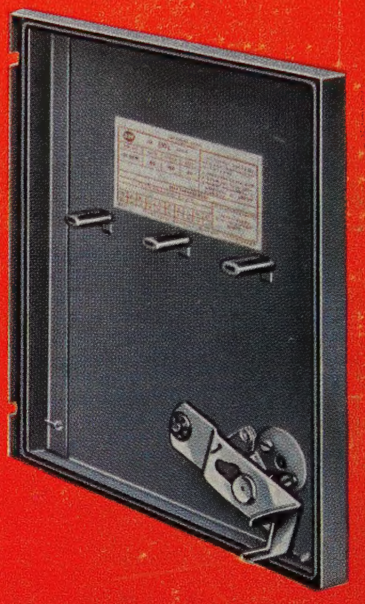
Fabricated cases are of heavy gauge sheet steel with hinged covers, rust-proofed and finished grey stove enamel. Chrome plated front operating switch handles.

Removable endplates are provided at top and bottom of case with semi-pierced knockouts which, on removal, provide clearance holes for conduit.





The hinged covers are detachable in order to facilitate wiring or to preserve finish.



Gaskets are fitted to all covers, rendering the switchgear enclosures dust and weather proof.

H.R.C. cartridge patterns, which are interchangeable with the semi-enclosed rewirable patterns, comply with B.S.88. 1952.

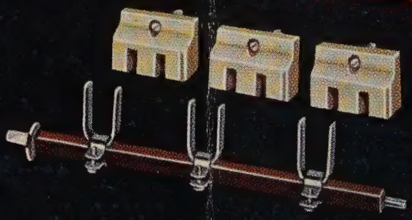
M.E.M. H.R.C. cartridge fuse carriers are designed to accommodate H.R.C. cartridge fuse-links to B.S.88.1952, Appendix 'J' Dimensions, Form A-Offset Tags.

All live metal is adequately shielded to avoid accidental contact when cover is open. The porcelain shields also serve as efficient arc barriers.

Wiring space is generous. A detachable switchbar facilitates wiring.

All units are arranged for internal fixing. Keyhole slots are provided at top. There are no external lugs.

The 'Exel' range ensures compliance with the most strict interpretation of I.E.E. Regulations (13th Edition), and with the requirements of The Electricity (Factories Act) Special Regulations.



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